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Final Engineering Report

Mariner C - 64

Trapped Radiation Detector, Unit 25

JPL/University of Iowa Contract 950613

under NAS 7-100

19 February 1965

Prepared by
Department of Physics and Astronomy
University of Iowa
Iowa City, Iowa

for

Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, California

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1.5 163

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1. Summary

1.1 Object of Report. The object of this report is to provide a concise technical description of the Mariner C program at the University of Iowa under JPL/University of Iowa Contract 950613, 17 May 1963 through 30 December 1964.

1.2 Scope of Work

1.2.1 Experiment Models. Design, fabricate, test, and deliver the following models of a Trapped Radiation Experiment:

- a. 1 Engineering Prototype/Type Approval (EP/TA) Model.
- b. 1 Proof Test Model (PTM/MC-1).
- c. 3 Flight Models (MC-2, MC-3, MC-4).
- d. 1 Set of Spare Parts (MC-5).

1.2.2 Bench Checkout Equipment. Design, fabricate, test, and deliver three sets of Bench Checkout Equipment (BCE) for the above experiment.

1.2.3 Services

- a. Establish engineering liaison with JPL.
- b. Furnish qualified personnel to perform engineering services at JPL and at ETR as required.

1.2.4 Documentation. Provide detailed technical and financial documentation for the project.

1.3 Results. The U of I MC-2 experiment was launched aboard the MC-2 spacecraft (Mariner-3) on 5 November 1964. The mission was unsuccessful although the U of I experiment operated properly. MC-3 was launched aboard the MC-3 spacecraft (Mariner-4) on 28 November 1964. It has operated properly through 19 February 1965.

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5. General Description

- 5.1 Mission Objectives. The University of Iowa Mariner C Trapped Radiation Experiment (Unit 25) is an array of particle detectors designed to search for and to measure any belts of trapped radiation possessed by Mars and to measure interplanetary cosmic rays while en route to Mars. These measurements will include flux, energy, directional characteristics, and identities of the particles.
- 5.2 General. In accordance with JPL/U of I contract 950613, the University of Iowa designed, constructed, tested, and delivered the following units and documentation:
- 5.2.1 Thermal Control Model (TCM). This unit consisted of a subchassis containing dummy detectors and no electronics. The mass and size of the TCM were a close approximation of the subsequent flight units. The TCM was tested by JPL to determine the inherent thermal properties of unit 25 and to devise passive means of thermal control for the flight units.
- 5.2.2 Engineering Prototype/Type Approval (EP/TA). The EP/TA model was constructed as a fully operational unit except it possessed no means of thermal control. The instrument was subjected to, and passed the entire battery of environmental tests as called out in JPL EPD-59, specification number 30250 B.
- 5.2.3 Proof Test Model (MC-1). The PTM was the first flight quality instrument constructed. It was subjected to flight acceptance environmental tests (see EPD-59, Specification 30251 B). It was then used for integration and spacecraft testing.
- 5.2.4 First Flight Unit (MC-2). This was the first flight unit. The unit was launched aboard the MC-2 spacecraft (Mariner 3) on 5 November 1964. The mission was unsuccessful although the SUI experiment apparently operated properly.
- 5.2.5 Second Flight Unit (MC-3). MC-3, unit 25 was launched aboard the MC-3 spacecraft on 28 November 1964. It has operated properly through 19 February 1965.

- 5.2.6 Flight Spare MC-4. This instrument was intended to be used as a back up unit for flight units MC-2 and MC-3.
- 5.2.7 MC-5. This was an assemblage of spare sub-systems and components of unit 25.
- 5.2.8 Bench Checkout Equipment (BCE). Three complete sets were designed, constructed, assembled, and tested. The first two sets were delivered to JPL for bench testing of unit 25. The remaining unit was retained at the University of Iowa. Checkout sources were provided for EP/TA, MC-1, 2, 3, 4, 5.
- 5.2.9 Documentation
- a. Functional Specifications.
 - b. Environmental Test Specifications.
 - c. Design Specifications.
 - d. Detail Drawings.
 - e. Materials Lists.
 - f. Flow Plans.
 - g. Equipment Certification Data for Each Instrument.
 - h. Quality Assurance Plan.
 - i. Quality Control Plan.
 - j. Electronic Components Parts List.
 - k. Failure Reports as Necessary.
 - l. Monthly Technical Reports.
 - m. Monthly Financial Reports.
 - n. Final Engineering Report.

5.3 Weight. The total weight of this experiment: ~2.15 pounds.

5.4 Power. Power required: ~380 milliwatts (supplied as a 2400 cps square wave).

5.5 Location on Spacecraft. The University of Iowa Mariner C Trapped Radiation Experiment was mounted on the Mariner C spacecraft in Section IV as is shown on JPL drawing number 4190502.

5.6 Configuration. The configuration of the experiment is a rectangular box 5" by 5.5" by 3". All of the particle detectors are mounted on one surface of this box and all of the subsystems contained inside (see University of Iowa drawing number 33-1003-C).

5.6.1 Detector View Angles

- a. Detector A: This detector has an unshielded window and a full view angle of 60° directed 135° from the probe-sun line. There are no obstructions in its field of view.
- b. Detector B: This detector has an unshielded window and a full view angle of 60° , directed 70° from the probe-sun line. There are no obstructions in its field of view.
- c. Detector C: This detector has a window shielded by approximately 20 mg/cm^2 of aluminum. View angle and direction are identical to Detector B.
- d. Detector D: View angle and direction are identical to Detector B.

6. Particle Detectors

- 6.1 Geiger Mueller Counters. Detectors A, B, and C are type 6213 mica end window GM counters made by the Eon Corporation. Their energy threshold is nominally 40 keV for electrons and 500 keV for protons. The 6213 measures the total number of charged particles passing through its sensitive volume. The sensitive volume of each tube is shielded such that particles of low and moderate energies may only enter through the window. Much higher energy particles may enter from other directions. By allowing for the omnidirectional flux of high energy particles a directional measurement of the low energy particles is obtained.
- 6.1.1 Apertures. The diameter of the aperture of Detectors A, B, and C is 0.120 inches. Since the 6213 tube will count hard ultraviolet photons, each aperture is shaded from the sun by making the entrance corridor a 60° oblique truncated cone. The result is analogous to the visor on a cap (drawing number C35-0014C). Behind the aperture on Detector C is approximately 20 mg/cm² (~ 0.0025 in.) of aluminum. This serves to increase the threshold energy to 130 keV for electrons and 3 MeV for protons. Detectors A and B have no foil shields and are 40 keV/500 keV tubes.
- 6.2 PN Junction Detector (Silicon Surface-Barrier Diode). The solid state detector (Detector D) is a two-channel proton spectrometer. The detector and all of its associated electronics are enclosed in a gold plated RF tight box (University of Iowa drawing number D37-1001).
- 6.2.1 Intended Objectives. Detector D measures flux and energy of protons and alpha particles within specific energy ranges while being essentially insensitive to electrons of all energies. It also makes possible the differentiation between the electrons and protons counted by the GM counters.

6.2.1.1 Functional Specifications. The full look angle of Detector D is 60° and the area is between $7\text{-}8\text{ mm}^2$; hence the geometric factor of the detector is about 0.06 cm^2 steradian.

The energy discrimination levels are:
Channel D1, 500 keV and 11 MeV;
Channel D2, 880 keV and 4 MeV.

Detector D contains an on-board Am 241 radioactive source of low intensity ($< 0.01\text{ }\mu\text{ C}$) to establish background counting rates. For Channel D1, this rate is 3 to 4 counts per minute, and for Channel D2, it is 2 to 3 counts per minute.

The maximum counting rates of Channels D1 and D2 are about 35,000-41,000 counts per second.

6.2.2 Electron Sensitivity. The sensitivity to electrons of the detector is minimized (almost to zero) by three factors. First, the detector is too thin to absorb much energy from electrons. Second, the discrimination level is set much higher than the expected electron energy loss. Third, the pulses are clipped very short so as to avoid pile up of low energy electrons.

6.2.3 Detector Grounding Problem and Solution.

Early in the project, after the first few silicon surface barrier detectors were delivered to the University of Iowa, it became apparent under microscopic examination that the ground contact of the detector was not exceptionally good. The detectors on hand were selected on the basis of the appearance of a physically sound ground contact and the manufacturer was notified of the problem which he promised to correct.

However, the detector in MC-4, although apparently well grounded, failed at JPL. The failure was traced to the broken ground contact. This failure raised doubt as to the quality of the contacts on MC-2 and MC-3.

A conducting epoxy, Eccobond 56C (Emerson Cumming) was successfully used to adequately secure the ground connection on some sample detectors. The electrical characteristics of these detectors were equal to or better than they were originally. A few detectors did become noisy but seemed to "heal themselves" as time passed. Type-approval vibration tests were used in addition to a number of temperature cycles to test the permanence of the ground contact. There were no failures after being properly treated in this fashion.

The flight detectors for MC-2, MC-3, and MC-4 were all restored with this epoxy.

Although it was impossible to duplicate the intermittent ground and thus investigate the behavior of the detector, it appeared that the following is a possible sequence of events:

(1) The ground contact was "half broken" in such a way that a very high resistance and capacitance appeared across the input of the charge sensitive preamplifier with the result that the amplifiers were driven into oscillation (output counting rates up to 40,000 c/s).

(2) If the break in the ground contact was more or less "clean", i.e., open, the detector was not grounded at all. The pulses at the input of the preamplifier were greatly diminished so that the counting rate dropped to zero.

The above sequence of events fit well with the observed failure of MC-4. First a very high counting rate occurred, then a zero counting rate occurred. The diminished pulse-heights were observed at the output of the amplifiers.

Although the alleged failure of MC-2 was not duplicated on the bench, the data through the spacecraft system could be explained by reference to (2) above.

There were no further troubles of this nature.

7. Electronics

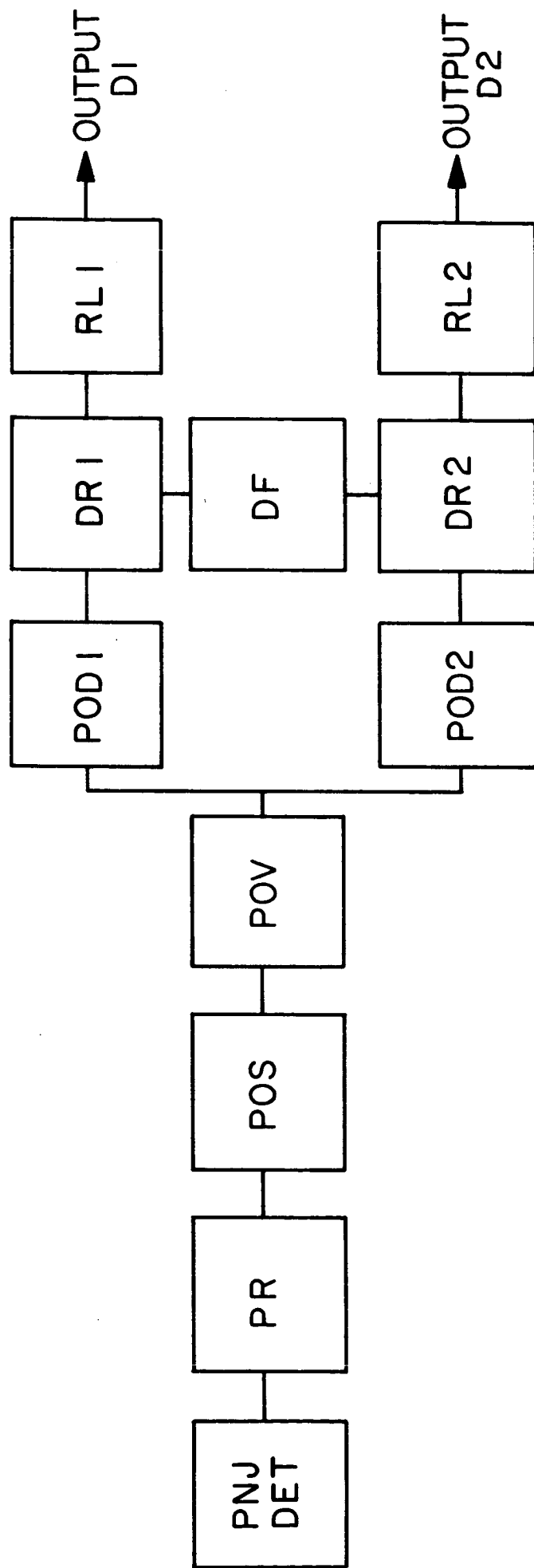
7.1 GM Preamplifiers. The output pulses from each of the GM counters is sent to one of the amplifiers. Each amplifier is a complementary NPN-PNP saturating device which shapes and conditions the GM pulses to meet the DAS interface requirements. These amplifiers were designed, fabricated, and tested by the University of Iowa (Drawing C33-3001).

7.2 PN Junction Detector Electronics. The overall operation of the detector, from data generation to data conditioning, may be understood by referring to Figure 1. All design, fabrication, and testing of these circuits was done by the University of Iowa (Drawing C37-2006).

7.2.1 Preamplifier. A charged particle entering a solid state detector will release a number of electrons proportional to the energy of the particle which is lost in the detector. Taking this amount of charge into consideration along with the detector capacitance, a corresponding voltage pulse will occur at the output. The capacitance of a solid state detector varies when the detector pulse varies. However, charge released by the particle does not change with capacitance. This makes the charge sensitive amplifier a great deal more desirable than a voltage amplifier [Fillius, 1963] (Drawing C37-3005).

7.2.2 Post Amplifiers. The post amplifiers of this instrument are highly stable negative feedback voltage amplifiers. They receive pulses from the preamplifiers, amplify them, and send them to the discriminators. The overall gain of each string of post amplifiers is adjusted so as to give voltage pulses at the discriminators of levels corresponding to the particles detected (Drawing 37-3007).

7.2.3 Discriminators. These circuits are based on temperature stabilized voltage discriminators which accept voltage pulses above a pre-set level (> 1.4 volts). All pulses under this value are rejected (Drawing 37-3004).



PR = PREAMPLIFIER
 POS = POSTAMPLIFIER
 POV = POSTAMP (VARIABLE GAIN 4-20)
 POD1 = POSTAMP CHANNEL D1
 POD2 = " " D2
 DR1 = DISCRIMINATOR CHANNEL D1
 DR2 = " " D2
 RL1 = RATE LIMITER D1
 RL2 = " " D2
 DF = DISCRIMINATOR REFERENCE PACK

FIGURE 1

- 7.2.4 Output and Rate Limiter. This circuit is based on a monostable multi-vibrator. It receives the data from the discriminators and serves to limit the maximum counting rates below 50,000 c/sec. Also incorporated are circuits which standardize the pulses to meet the Spacecraft Data Automation System (DAS) interface requirements (Drawing 37-3003).

8. Power Supply

The Unit 25 power supply was designed, fabricated, and tested by the Matrix Corporation of Nashua, New Hampshire to the University of Iowa and JPL specifications.

8.1 Configuration. The power supply was packaged such that all components were mounted on two, back-to-back, single sided printed circuit boards 2.75 inches by 3.50 inches. After the testing phase each power supply was potted, then foamed, which resulted in a vertical dimension of 1.50 inches. Weight before potting = 193 grams. Weight after potting = 282 grams. (Drawing C33-1002)

8.2 Input. The unit 25 power supply was driven by the space-craft power system as follows:

Frequency: 2400 cps square wave

Voltage: 50 v rms \pm 2%

Rise Time: 5 ± 4 μ sec

Experiment Power

Requirement: 400 milliwatts

8.2.1 Input Limiter. Incorporated in the design is a current limiter which limits the input current to below 400% of normal full load input current.

8.2.2 Fusing. The unit is also protected by a pair of 50 ma fuses, in parallel, inserted in the 50 VAC input. Since these fuses were installed late in the program they are not inside the power supply itself but on the back of the subchassis near the power connector (Drawing E33-1003-C).

8.3 Outputs

8.3.1 High Voltage Section. The high voltage section was designed to the following specifications:

Voltage: 900-1000 VDC unregulated

Current: 100 μ a constant load

Ripple: 100 mV peak to peak maximum

This voltage served as the input to the corona regulator tubes.

8.3.1.1 Corona Discharge Tubes. Corona regulators (VR tubes) were selected such that their operating voltage matched that of its associated GM counter. These regulator tubes and the entire high voltage section were potted in Eccosil silicone rubber prior to foaming the power supply with Eccofoam.

8.3.2 Detector D Bias Supply

Voltage: +75 VDC \pm 1%

Current: 50 μ a

Ripple: < 1 mV high frequency

8.3.3 Circuit Supply

Voltage: + 8 VDC at 15 ma (set within \pm 0.2 V)

Current: 25 ma maximum

Ripple: < 2 mV

8.4 Corona Regulator Tube Pulsing Problem. Quite late in the project, certain anomalies were discovered in the data of MC-4 at low temperatures. The counting rates were high which is contrary to normal low temperature operation, i.e., low counting rates. It was discovered that the VR tubes were putting out pulses whenever their associated GM counter counted rapidly. A plausible explanation is this: Whenever the GM counter counts rapidly, the VR tube sees a burst of current pulses demanded by the GM tube driving the voltage below the regulating point. This triggers the VR tube into a regenerative region and the anode rapidly drops (< 1 μ sec) to near zero volts before it can recover. The best solution found to this problem is to connect a capacitor across the VR tube. This capacitor serves to supply the current pulses required without an appreciable drop in voltage.

This corrective measure was taken in MC-4 but not in any of the other units.

9. Mechanical Design

- 9.1 Experiment Subchassis. The experiment subchassis was machined from cold-rolled magnesium alloy AZ-31B-H24. The box is divided into an upper and a lower compartment by a bulkhead to which are affixed most of the subsystems and components (Drawing E33-0001E). The subchassis for the TCM and the EP/TA were built by the University of Iowa. The subchassis for MC-1, 2, 3, 4, and 5 were built by the New Era Industries Company, Cedar Rapids, Iowa.

An error in the location of the mounting holes in the feet of the MC-1, 2, 3, and 4 subchassis was corrected by the following method: The holes which were improperly located were drilled and tapped to 5/16-24 NF thread. A threaded plug of magnesium was screwed into the holes. A small hole was then drilled lengthwise down through the threads and a pin inserted into this hole to secure the plug in the hole. The mounting holes were then redrilled in the correct location.

- 9.2 PN Junction Structure. The PN junction structure and covers were machined from cold rolled magnesium alloy ZA-31B-H24. The top and bottom covers are removable and are shielded against radio frequency interference by money-metal "rope" gaskets.
- 9.3 Detector Housings, Structural Components, and Special Hardware. Detector housings and structural components were fabricated from cold rolled magnesium alloy AZ-31B-H24. The PN junction aperture was fabricated from non-magnetic brass. Special screws were fabricated from non-magnetic brass and non-magnetic stainless steel. See drawings for construction details. Standard screws were of titanium, furnished by JPL.
- 9.4 Surface Treatment. The subchassis for the TCM and EP/TA experiments were surface treated with Dow 7 dichromate at the University of Iowa. The subchassis for the MC-1, 2, 3, 4, and 5 models were treated with grit blast and dichromate per JPL specification 90433.

The PN junction structure was gold plated to provide good conduction between covers and structure and thus provide protection against RF interference.

Grit blasting, dichromating, and gold plating of MC-1, 2, 3, 4, and 5 components were done by Anchor Plating and Tinning Co., South El Monte, California.

GM tube housings on TCM and EP/TA were treated with Dow 7 dichromate and later gold plated. Those on MC-1, 2, 3, 4, and 5 were gold plated without the dichromate. Bores of the tube housings were treated with Dow 19.

- 9.4.1 Gold Plating. Early in the program it was discovered that pin holes were appearing in almost all gold plated magnesium surfaces. Microscopic examination indicated that copper or silver sub-plating was "bleeding" through the gold exposing the under surface to the atmosphere. These surfaces were replated, still maintaining the 0.0005" minimum of copper and 0.0005" minimum of silver but increasing the gold to 0.0003". (JPL specifications originally called for 0.0001".) No further trouble of this nature occurred.

10. Thermal Design

- 10.1 General Information. Unit 25 was located on the upper ring of the spacecraft octagon section and slaved to its temperature. The spacecraft thermal shell was shaped such that the ends of the four detectors and the outboard face of the experiment were exposed to space. The outboard face of the chassis was painted with white paint (PV-100) to achieve the desired temperature range of approximately 100°F near earth and 50° F near Mars.

The GM tube housing and PN junction aperture on MC-1, 2, 3, and 4 were gold plated. Indium foil was used between the GM tube housings and the subchassis to improve thermal conductivity on MC-2, 3, and 4.

The bottom half of the PNJ aperture was painted white in order to lower the temperature of this detector to about 82° F near earth and 37° F near Mars.

Thermal design was performed by Jet Propulsion Laboratory.

- 10.2. Temperature Transducer. A temperature transducer (TS1 T4086S1) was provided by JPL and installed in each experiment at the University of Iowa. Identification of the transducers installed in various units are given in Table I.

<u>Table I</u>	
<u>Experiment</u>	<u>Transducer Serial Number</u>
EP/TA	41873
MC-1	41872
MC-2	41871
MC-3	41870
MC-4	41869

- 10.3 Temperature Control Model (TCM). A temperature control model was delivered to JPL for use in the thermal design of the spacecraft and the SUI experiment. The TCM was similar to the flight models in weight and configuration but contained no electronic subassemblies.

11. Bench Checkout Equipment (BCE)

- 11.1 Description. The bench checkout equipment (BCE) for the University of Iowa Mariner C experiment was especially simple since no timing signals were required to operate it. All detectors are operating whenever power is applied.

The BCE consists of a Glentronics, Inc., AC power supply to simulate the spacecraft power system, a Beckman electronic counter to count detector output pulses, a Tektronix oscilloscope to monitor the electrical properties of those pulses, a Beckman printer to record permanently the counter output, and a push button assembly to select the desired detector output. Only one detector was monitored at a time.

This equipment was mounted in a standard 19-inch rack (see II-20).

12. Quality Assurance and Control

Quality assurance and control was provided by adherence to appropriate U of I and JPL specifications listed in Section 14 of this report. Screened electronic components were provided by JPL. These components were used in MC-2, 3, 4, and 5. Components, unscreened by JPL, but tested in accordance with normal U of I practice were used in EP/TA and MC-1.

University of Iowa and JPL inspectors performed in-process and final inspections on all modules, sub-assemblies and completed experiments.

12.1 Visual Inspection and Temperature Tests. Testing of the University of Iowa Mariner C experiment was done at various stages of fabrication as shown below:

- a. Component: Visual and microscopic inspection of all components in accordance with applicable U of I and JPL specifications.
- b. Module: Visual and microscopic inspection. Preliminary electrical tests over temperature range of -20°C to $+65^{\circ}\text{C}$ before and after conformal coating.
- c. Subassembly: Visual and microscopic inspection. Electrical tests over temperature range of -20°C to $+65^{\circ}\text{C}$.
- d. Experiment: Visual inspection. Electrical check --all detectors, all counting rates.
Temperature test: -10°C to $+50^{\circ}\text{C}$ operating
 -30°C to $+60^{\circ}\text{C}$ survival.

12.2 Vibration Testing. Vibration testing was performed at the University of Iowa, according to JPL Specifications 30250B and 30251B, on each experiment before being delivered to JPL.

In the event any module had to be replaced, a second vibration test was performed. This test was run to the same g-levels but of time duration one-half of that called for in the JPL Specification.

13. Experiment Information and Test Data

13.1 Weight and Power of Specific Experiments.

Listed in Table II is weight and power information concerning each experiment (measured at JPL by D. Schofield of JPL).

<u>Table II</u>		
<u>Experiment</u>	<u>Weight (lbs.)</u>	<u>Power (watts)</u>
EP/TA	2.10	0.36
MC-1	2.34	0.38
MC-2	2.13	0.38
MC-3	2.20	0.35
MC-4	2.15	0.36

13.2 Test Sources and Expected Counting Rates.

Sources and expected counting rates of the experiments with their assigned sources in standard source holders are given in Table III. The sources used were as follows:

GM Checkout---Co 60; ~ 200 μ C; 1.3 MeV γ

PNJ Checkout--Po210; < 10 μ C; 5.5 MeV α , 0.6 MeV γ

Table III

Experiment	GM Source		PNJ Source		Date of Data Run	Expected Counting Rates (Counts/Second)				
	S/N	μ C	S/N	μ C		A	B	C	D1	D2
EP/TA*	C-62	223	Unmarked	< 10	July 64	6.1	54.7	21.7	80.4	80.3
MC-1*	C-68	206	3	< 10	Aug. 64	9.8	156.5	43.9	45** 7.3	43** 6.5
MC-2	C-69	190	2	< 10	April 64	12.1+1.2	161+8.	64.4+1.9	77.3+7	78.3+7
MC-3	C-70	185	7	< 10	May 64	12.1+2.5	56.8+5***	153.1+8***	50.0+5.6	49.1+5.6
MC-4	C-71	190	8	< 10	June 64	9.5+1.5	145+7	54.8+3.5	49.6+5.5	48.7+5.5

* EP/TA and MC-1 counting rates measured at JPL at times indicated. All other counting rates measured at the University of Iowa.

** The PNJ detector was replaced in April 1964 with one of smaller area. The higher counting rates occurred prior to April 1964.

*** Detectors B and C were physically interchanged on MC-3. They are electrically identical to all other units. The source normally is placed on the "middle" GM tube and thus the difference in counting rates.

14. List of Applicable Documents

14.1 University of Iowa Documents

- a. Proposed Experiment for Mariner C 1964 Missions
March 4, 1963.
- b. Mariner C-64 Functional Specifications for Trapped
Radiation Detector--Unit 25
20 June 1963 including Amendment I of 12 September
1963.
- c. Design Specification Mariner C-64 Trapped Radiation
Detector, Unit 25
30 August 1963 including Amendment 1 of 12 August
1964.
- d. Test Specification Mariner C-64 Trapped Radiation
Detector, Unit 25
12 August 1963.
Amendment to this specification of 24 December 1963
was later rescinded.
- e. Mariner Mars 64 Parts List
24 February 1964
Including Mariner C-64 Power Supply Parts List
(Matrix Corporation).
- f. Mariner C-64 List of Drawings Rev. C
3 September 1963.
- g. Quality Control Requirements for Mariner C-64
Experiment
26 September 1963.

14.2 Jet Propulsion Laboratory Documents

- a. Procedures and Requirements for Scientific Instru-
ments, Mariner Mars-64, EPD-59.
- b. JPL Spec. 30250B, Environmental Specification,
Mariner C Flight Equipment, Type Approval Environ-
mental Test Procedures (Assembly Level).
- c. JPL Spec. 30251B, Environmental Specification,
Mariner C Flight Equipment, Flight Acceptance
Environmental Test Procedures and Preacceptance
Test Limits (Assembly Level).

15. Project Personnel

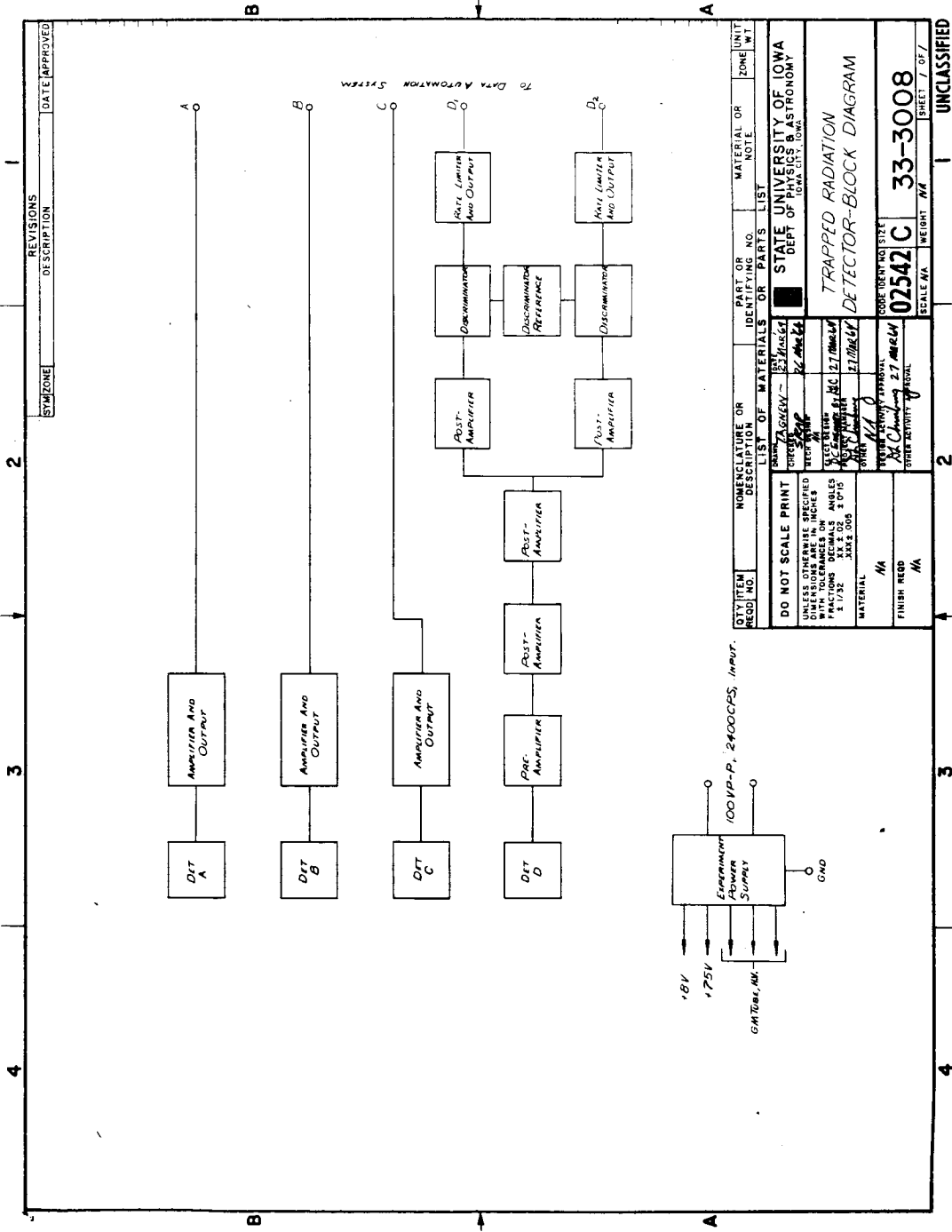
University of Iowa personnel directly involved in the conception, planning, design, fabrication, testing, and delivery of this experiment are as follows:

J. A. Van Allen	Principal Investigator	General director of the project.
T. Armstrong	Experimenter	PNJ detectors: testing, calibration, and field support.
D. L. Chinburg	Project Manager	Responsible for overall conduct of the project.
J. D. Craven	NASA Trainee	GM detectors: testing, calibration, and delivery.
G. Crossett	Designer	Packaging designs and layouts of electronic circuitry.
D. C. Enemark	Senior Design Engineer	Responsible for design of all detector electronics. Supervised all electronics, fabrication, and testing.
L. A. Frank	Co-Investigator	Responsible for scientific design criteria for GM detectors; procurement, testing, calibrating, and delivery of GM detectors.
E. A. Freund	Instrument Shop Supervisor	Responsible for all local fabrication of mechanical parts.
R. H. Gabel	Project Coordinator	Performed detailed coordination of design, fabrication, testing, delivery, and field support of the Mariner experiment.
R. A. Ganfield	Technician	PNJ testing and calibration, BCE fabrication.
J. S. Hathaway	Technician	Responsible for the quality control of the project.

N. K. Henderson	Technician	Testing, calibration, delivery, and field support of GM detectors.
H. K. Hills	NASA Trainee	GM detector and associated voltage regulator tube procurement, testing, calibration, delivery, and field support.
F. Kolpin	Technician	Assistant to the Project Manager.
S. Krimigis	Co-Investigator	Responsible for scientific design criteria for PN junction detector and associated electronics. Procurement, testing, calibrating, and field support of PNJ detectors.
E. Lawrence	Mechanical Designer	Responsible for design, fabrication, and finishing of mechanical parts, and preparation of all finished drawings.
M. Murphy	Electronics Shop Supervisor	Responsible for assembly of all electronics modules and harnessing of the experiments.
S. R. A. Robinson	Mechanical Engineer	Responsible for general design, vibration analysis, and testing of the experiment.
M. Schug	Technician	Assistant to the Project Coordinator.
T. Schweitzer	Technician	Project quality control.
J. F. Skerik	Project Administrator	Assistant to Project Manager.
W. Stanley	Technician	Project quality control, testing, and field support.
E. W. Strein	Technician	Construction and testing of PNJ detectors; packaging design of PNJ electronics; supervised design and construction of the BCE.
R. Wenman	Electronics Shop Technician	Assembly of electronics modules and harnessing of the experiments.

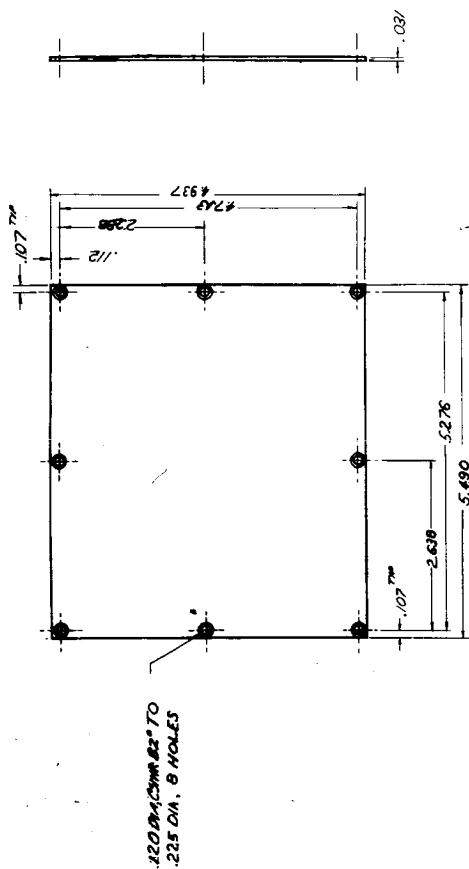
Appendix I

D R A W I N G S



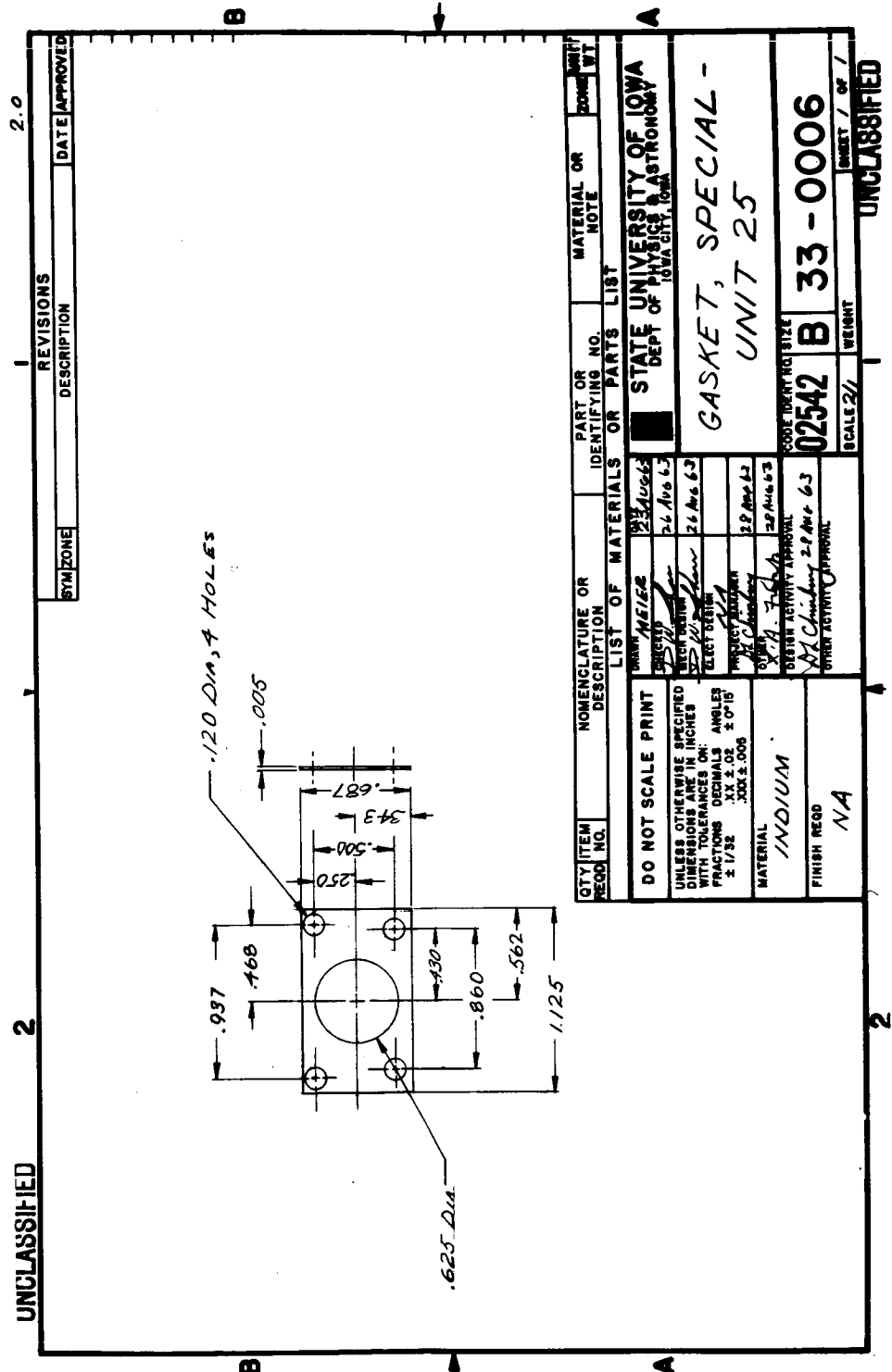
QTY	ITEM	DESCRIPTION	NOMENCLATURE OR PART OR IDENTIFYING NO.	MATERIAL OR NOTE	UNIT
1	DO NOT SCALE PRINT	STATE UNIVERSITY OF IOWA DEPT. OF PHYSICS B ASTRONOMY			
1	UNLESS OTHERWISE SPECIFIED				
1	ALL DIMENSIONS ARE IN INCHES				
1	FRACTIONS DECIMALS ANGLES				
1	WITH TOLERANCES ON				
1	2. 1/32 .005				
1	3X3.005				
1	MATERIAL				
1	FINISH REQD				
1	STREET ADDRESS				
1	SCALE				
1	WEIGHT				
1	SHEET				
1	OF				
1	UNCLASSIFIED				

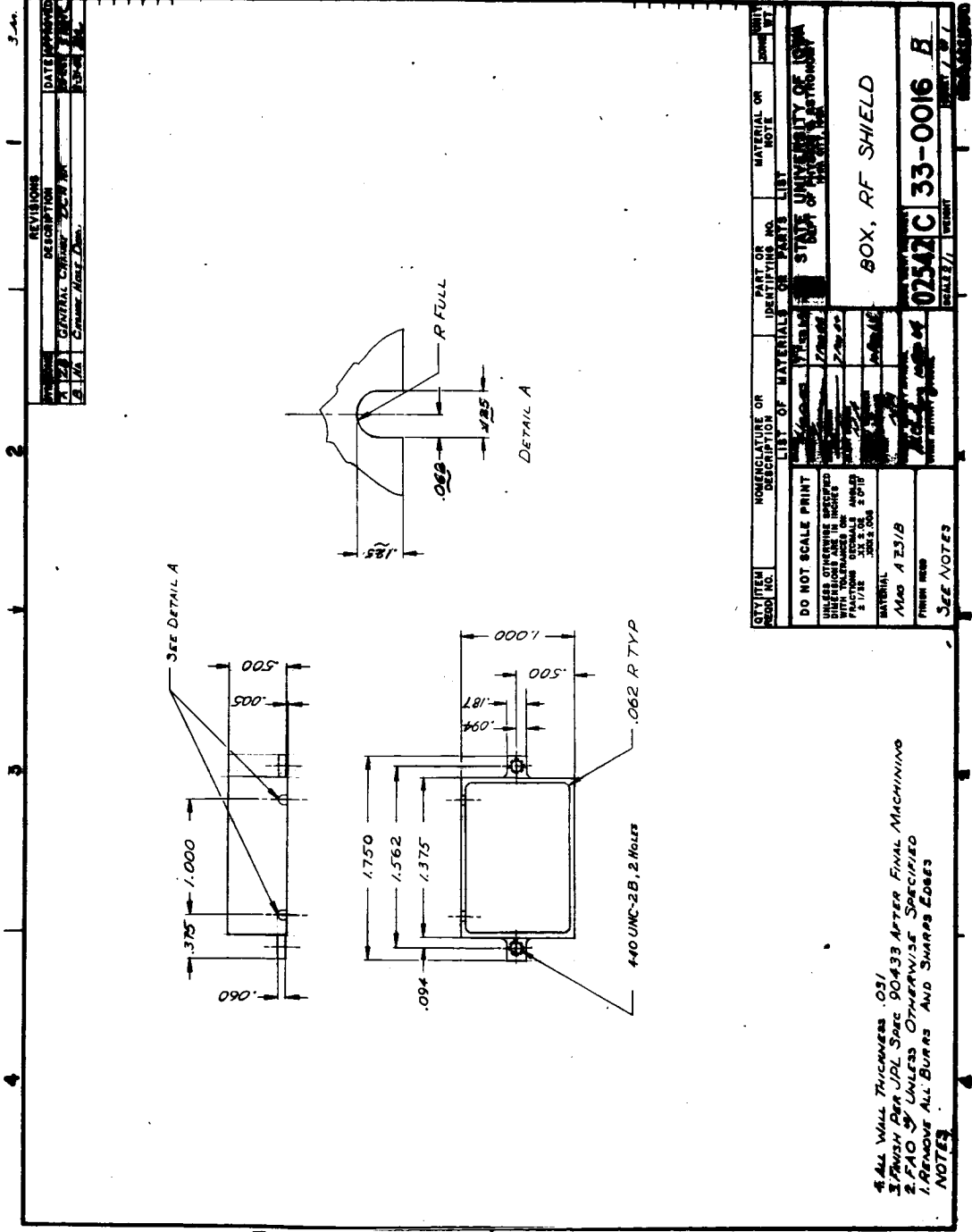
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[illegible]

3. REMOVE ALL BURRS AND SURFACES.
2. SURFACE PROTECTION PER JPL SPEC 90433 AFTER
FINAL MACHINING.
1. FINISH ALL OVER UNLESS OTHERWISE SPECIFIED.

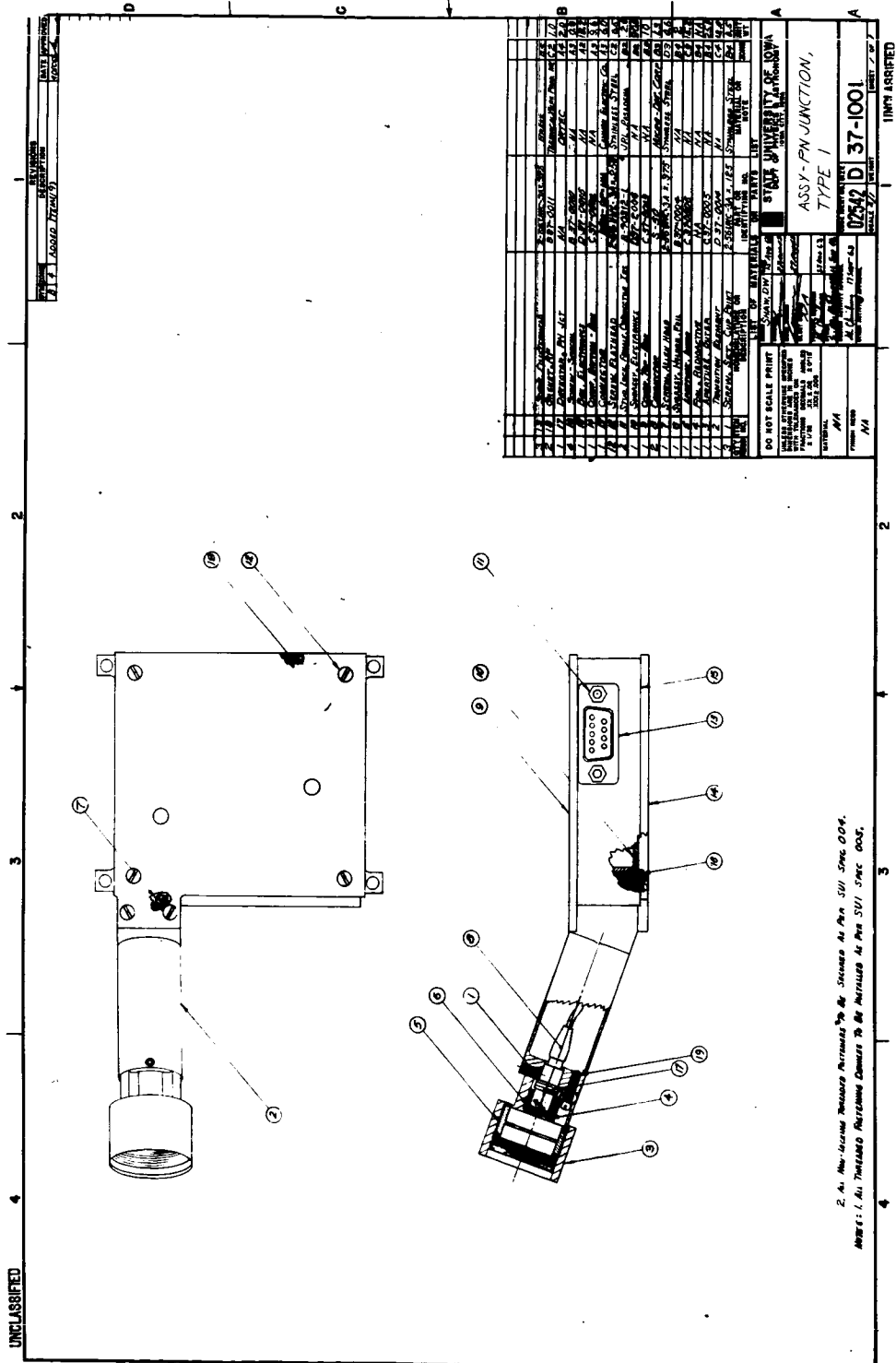
NOTES:





4. ALL WALL THICKNESS .031
3. FINISH PER JPL SPEC 90433 AFTER FINAL MACHINING
2. FAO 90433 UNLESS OTHERWISE SPECIFIED
1. REMOVE ALL BURRS AND SHARP EDGES

QTY/ITEM	DESCRIPTION	UNIT	QTY
1	BOX, RF SHIELD	EA	1
02542C 33-0016 B			
STATE OF TEXAS			
UNIVERSITY OF TEXAS			
AT AUSTIN			
DATE: 10/1/68			
BY: [Signature]			
CHECKED: [Signature]			
APPROVED: [Signature]			



2. All New-Design Weapons Referred To As: Same As Per SUI Spec 004.
 AND: 1. All THREADED MOUNTING CAMERS To Be ATTACHED As Per SUI Spec 004.

ITEM NO.	DESCRIPTION	QTY	UNIT	REMARKS
1	BASE PLATE	1	PC	
2	BASE PLATE	1	PC	
3	BASE PLATE	1	PC	
4	BASE PLATE	1	PC	
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6	BASE PLATE	1	PC	
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97	BASE PLATE	1	PC	
98	BASE PLATE	1	PC	
99	BASE PLATE	1	PC	
100	BASE PLATE	1	PC	

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2

SYMBOL

REVISIONS

DESCRIPTION

DATE APPROVED

2. REFERENCE DIMENSION, GASKET TO BE FITTED TO S.U.I. PN 237-0012.

NOTES: 1. MATERIAL: TECHNIT RFI GASKETING STRIP, ROUND CROSS SECTION, 1/16 DIA, TECHNIT PN 21110.

QTY	ITEM	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	MATERIAL OR NOTE	UNIT
1	DO NOT SCALE PRINT	UNLESS OTHERWISE SPECIFIED UNLESS NOTED OTHERWISE WITH TOLERANCES ON FRACTIONS DECIMALS ANGLES			
		± 1/32			
		XX ± .02			
		.XXX ± .005			
	MATERIAL	SEE NOTE 1.			
	FINISH REQD	NA			

LIST OF MATERIALS OR PARTS	LIST
STATE UNIVERSITY OF IOWA DEPT OF PHYSICS & ASTRONOMY IOWA CITY, IOWA	
GASKET - RF	
PN JUNCTION, TYPE I	

DATE	BY	CHKD	DATE
19 JUL 63	R. SPARKS	16 JUL 63	
19 JUL 63			
19 JUL 63			
9 AUG 63			
19 AUG 63			
19 AUG 63			

CODE IDENTIFYING	SCALE	1/1	WEIGHT	SHEET / OF
02542 B	37-0011			1 / 1

UNCLASSIFIED

UNCLASSIFIED

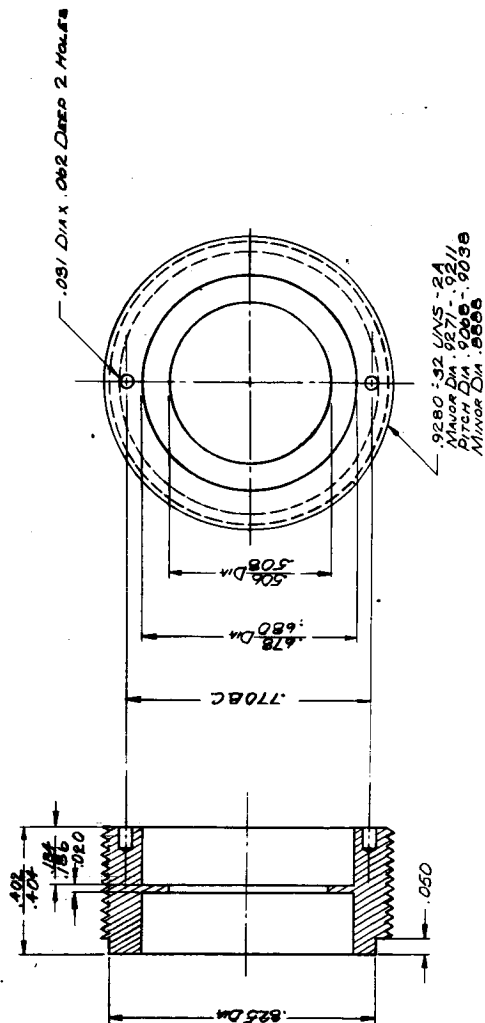
•

12

2

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5.0

[illegible]

UNCLASSIFIED

2

4.7

REVISIONS
SYNOPSIS DESCRIPTION DATE APPROVED

1
2
3

DO NOT SCALE PRINT
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
WITH TOLERANCES ON:
FRACTIONS DECIMALS ANGLES
XX ± .02 ± 0°15'
± 1/32 .001 ± .006 .001 ± .006

MATERIAL
NA

FINISH REQD
NA

NOTES: 1. PRESS FIT ITEM 2 INTO ITEM 1
2. WITH ITEM 3 PLACED AS SHOWN.

STATE UNIVERSITY OF IOWA
DEPT. OF PHYSICS & ASTRONOMY
SUBASSY, HOLDER, FOIL -
PV JUNCTION, TYPE I

02542 B 37-0004

SCALE 0/11 WEIGHT 2.06

UNCLASSIFIED

QTY	ITEM	DESCRIPTION	IDENTIFYING NO.	MATERIAL OR NOTE	UNIT
1	3	FOIL	A 37-0003	NA	192
1	2	HOLDER, FOIL, INNER	A 37-0002	NA	NA
1	1	HOLDER, FOIL, OUTER	A 37-0001	NA	NA

LIST OF MATERIALS ON PARTS LIST

UNCLASSIFIED

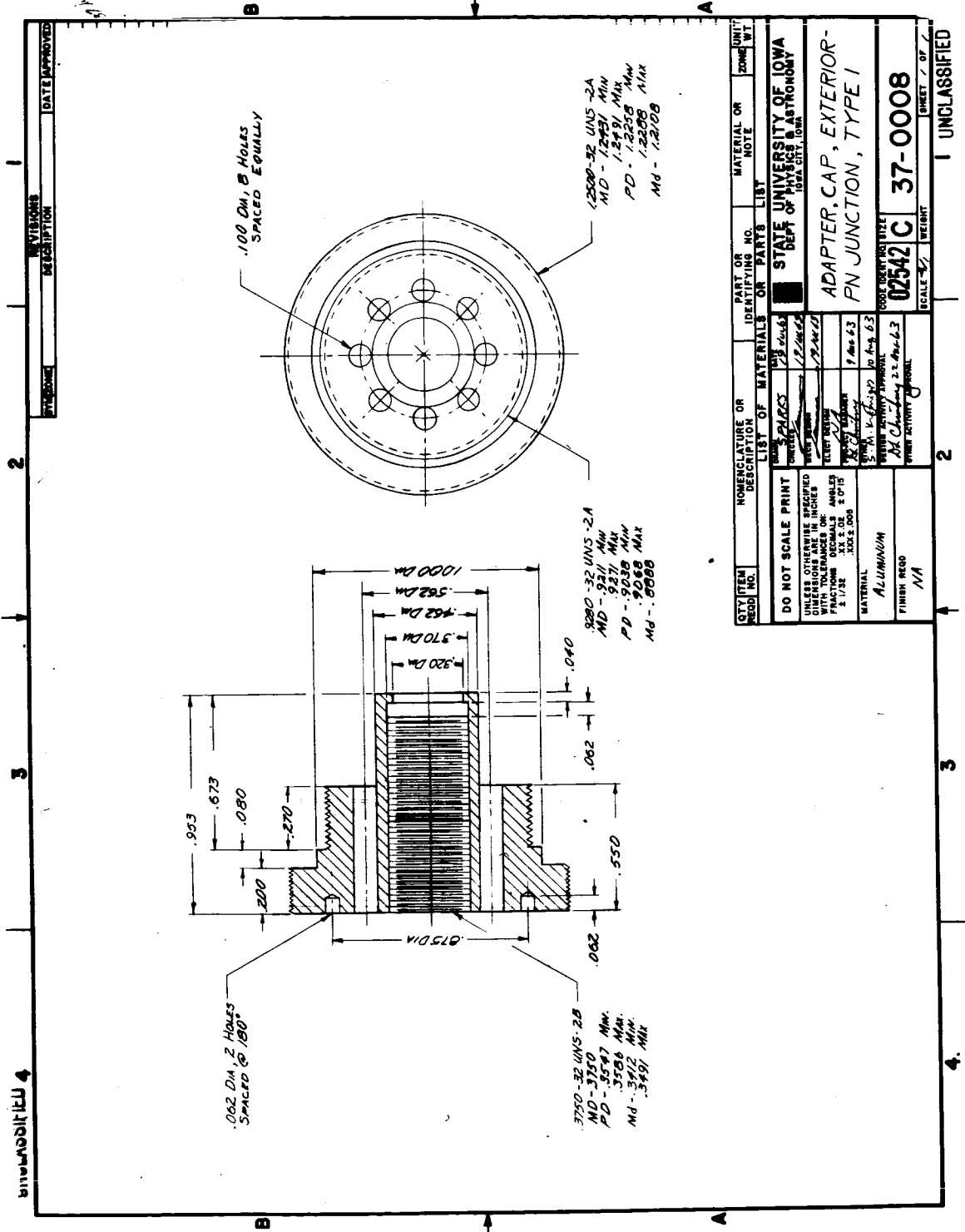
32

REVISIONS		DATE APPROVED																																										
SYM	DESCRIPTION																																											
QTY	ITEM	UNIT																																										
RECD	NO.	WT																																										
<p>DO NOT SCALE PRINT</p> <p>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES WITH TOLERANCES ON: FRACTIONS DECIMALS ANGLES ± 1/32 .XX ± .02 ± 0°15' .XXX ± .005</p> <p>MATERIAL NICKEL SILVER</p> <p>FINISH RECD NA</p>																																												
<p>STATE UNIVERSITY OF IOWA DEPT OF PHYSICS & ASTRONOMY IOWA CITY, IOWA</p> <p>HOLDER, FOIL, INNER - PN JUNCTION, TYPE I</p> <p>CODE IDENT NO. SIZE 02542 A 37-0002</p> <p>SCALE 4/1 WEIGHT 1.0 G SHEET 1 OF 1</p>																																												
<p>LIST OF MATERIALS OR PARTS LIST</p> <table border="1"> <thead> <tr> <th>DRAWN</th> <th>CHECKED</th> <th>MECH DESIGN</th> <th>ELECT DESIGN</th> <th>PROJECT MANAGER</th> <th>OTHER</th> <th>DATE</th> </tr> </thead> <tbody> <tr> <td>MEYER</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>JUN 26 63</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>JUL 63</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>JUL 63</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>6 AUG 63</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>10 AUG 63</td> </tr> </tbody> </table> <p>DESIGN ACTIVITY APPROVAL M. Chirley 22 AUG 63</p> <p>OTHER ACTIVITY APPROVAL</p>			DRAWN	CHECKED	MECH DESIGN	ELECT DESIGN	PROJECT MANAGER	OTHER	DATE	MEYER						JUN 26 63							JUL 63							JUL 63							6 AUG 63							10 AUG 63
DRAWN	CHECKED	MECH DESIGN	ELECT DESIGN	PROJECT MANAGER	OTHER	DATE																																						
MEYER						JUN 26 63																																						
						JUL 63																																						
						JUL 63																																						
						6 AUG 63																																						
						10 AUG 63																																						

UNCLASSIFIED

UNCLASSIFIED		2		40	
		REVISIONS DESCRIPTION DATE APPROVED		DATE APPROVED ADDED SET SCREW AND Baffle SCRAMBLER	
		SYMZONE A		DATE APPROVED ADDED SET SCREW AND Baffle SCRAMBLER	
1 6 SCREEN SET 1 5 SCREEN Baffle 1 4 ADAPTER CAP EXTERIOR-PN JCT. TYPE 1 1 3 Baffle-PN JCT 1 2 RING, RETAINING 1 1 CAP APERTURE EXTERIOR-PN JCT. 1 1 CAP APERTURE EXTERIOR-PN JCT.		0-80 UNC-2A x 1/25 A37-0036 C37-0008 A37-0007 N5002-100 C37-0009		STAINLESS STEEL NA NA NA NA WALDES KIMWOOD INC NA NA NA NA NA	
QTY ITEM REQD NO.		PART OR IDENTIFYING NO.		MATERIAL OR NOTE UNIT ZONE WT	
LIST OF MATERIALS OR PARTS LIST					
DO NOT SCALE PRINT UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES WITH TOLERANCES ON: FRACTIONS DECIMALS ANGLES $\pm 1/32$ $\pm .01$ $\pm 0'15$ $\pm .001$ $\pm .008$		SHAW, DIM 1/8 AUG 63 CHECKED 28 MAR 63 TECH DESIGN 28 MAR 63 ELECT DESIGN 28 MAR 63 PARTS MATERIAL 27 Sept 63 QTY, K-2, J-40 27 Aug 63 OTHER ACTIVITY APPROVAL 27 Sept 63 OTHER ACTIVITY APPROVAL		STATE UNIVERSITY OF IOWA DEPT OF PHYSICS & ASTRONOMY IOWA CITY, IOWA	
MATERIAL N/A		SUBBASSY, MOUNT- DESICCANT, PN JCT, TYPE 1		CODE IDENT NO SIZE 02542 B 37-0017	
FINISH REQD N/A		SCALE 2/1 WEIGHT		SHEET 1 OF 1	
UNCLASSIFIED		2		UNCLASSIFIED	

1. SOLDER ITEM (3) TO ITEM (3)
 NOTES: USING SOLDER, NON-
 CORROSIVE FLUX.



QTY ITEM REQD NO.	NOMENCLATURE OR DESCRIPTION	LIST OF MATERIALS ON PARTS LIST	PART OR IDENTIFYING NO.	MATERIAL OR NOTE	UNIT ZONE WT
1	DO NOT SCALE PRINT UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES FRACTIONS DECIMALS ANGLES X 1/32 X .001 X .015	3750-32 UNS-2B 9280-32 UNS-2A 12500-32 UNS-2A	12/10/63	STATE UNIVERSITY OF IOWA DEPT OF PHYSICS & ASTRONOMY 1000 UNIVERSITY AVE IOWA CITY, IOWA	
1	MATERIAL ALUMINUM	3750-32 UNS-2B	12/10/63	ADAPTER, CAP, EXTERIOR- PN JUNCTION, TYPE I	
1	FINISH REQD N/A	3750-32 UNS-2B	12/10/63		
1	QTY IDENTIFY SIZE 02542 C	3750-32 UNS-2B	12/10/63		
1	QTY IDENTIFY WEIGHT 02542 C	3750-32 UNS-2B	12/10/63		
1	QTY IDENTIFY SCALE 02542 C	3750-32 UNS-2B	12/10/63		
1	QTY IDENTIFY SHEET / OF 02542 C	3750-32 UNS-2B	12/10/63		

UNCLASSIFIED

1.0

SYMBOL		REVISIONS		DATE APPROVED	
		DESCRIPTION			
QTY ITEM REQD NO.		NOMENCLATURE OR DESCRIPTION		PART OR IDENTIFYING NO.	
DO NOT SCALE PRINT		DRAWN MEIER		STATE UNIVERSITY OF IOWA	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES WITH TOLERANCES ON: FRACTIONS DECIMALS ANGLES		CHECKED [Signature]		DEPT OF PHYSICS & ASTRONOMY	
± 1/32 .XX ± .02 ± 0°15'		MECH DESIGN [Signature]		IOWA CITY, IOWA	
XXX ± .005		ELECT DESIGN [Signature]			
MATERIAL		PROJECT MANAGER [Signature]		BAFFLE - PN JUNCTION,	
BRASS		OTHER [Signature]		TYPE 1	
FINISH REQD		DESIGN ACTIVITY APPROVAL [Signature]		CODE IDENT NO. SIZE	
		OTHER ACTIVITY APPROVAL [Signature]		A 37-0007	
		SCALE 2/1		WEIGHT	
				SHEET 1 OF 1	

5

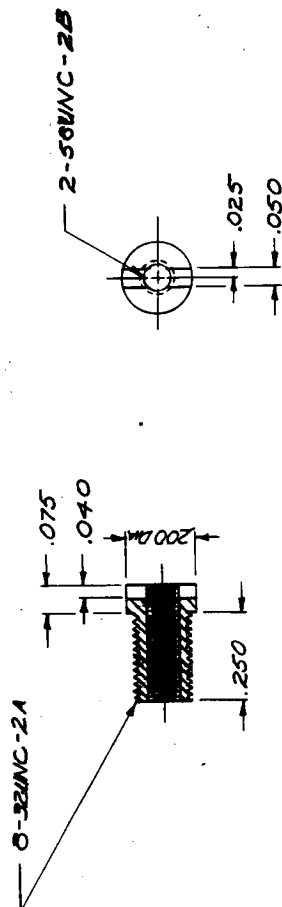
UNCLASSIFIED		2													
<p>3750-32 UNS-28 MA/DIA .3750 PITCH DIA .3586 MIN DIA .3491</p> <p>.062</p> <p>300</p> <p>1703</p> <p>.500</p> <p>703</p> <p>1.500</p> <p>.005</p> <p>1.500</p> <p>3000A</p> <p>FINE CROSS KNURL</p>		<p>REVISIONS</p> <table border="1"> <thead> <tr> <th>REV</th> <th>ZONE</th> <th>DESCRIPTION</th> <th>DATE APPROVED</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>A</td> <td>CHK. 9280 THD TO 3750 ADD .300</td> <td>FOOTER</td> </tr> <tr> <td>2</td> <td>B</td> <td>9280-32 UNS-28</td> <td></td> </tr> </tbody> </table> <p>MD. 9280 PITCH DIA 9077 - 9116 MINORDIA .8942 - .9021</p>		REV	ZONE	DESCRIPTION	DATE APPROVED	1	A	CHK. 9280 THD TO 3750 ADD .300	FOOTER	2	B	9280-32 UNS-28	
REV	ZONE	DESCRIPTION	DATE APPROVED												
1	A	CHK. 9280 THD TO 3750 ADD .300	FOOTER												
2	B	9280-32 UNS-28													
		<p>QTY ITEM REQD NO.</p> <p>DO NOT SCALE PRINT</p> <p>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES FRACTIONS DECIMALS ANGLES ± 1/32 .XX ± .02 ± 0°15' .XXX ± .005</p> <p>MATERIAL BRASS COML</p> <p>FINISH REQD N/A</p>													
<p>UNCLASSIFIED</p>		<p>2</p>													

UNCLASSIFIED

1.0

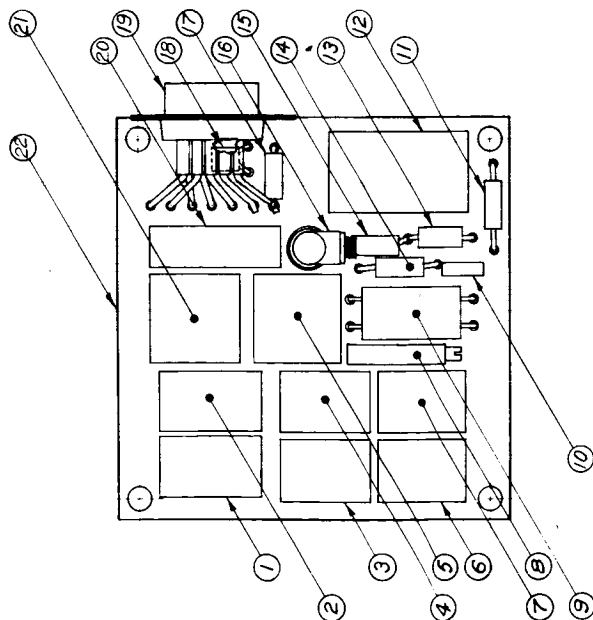
SYN		REVISIONS		DATE APPROVED	
DESCRIPTION		DESCRIPTION		DATE	
		<p>3. MACHINED FILLET RADIUS .020.</p> <p>2. FAO 125 UNLESS OTHERWISE SPECIFIED.</p> <p>NOTES: 1. REMOVE ALL BURRS AND SHARP EDGES.</p>		<p>STATE UNIVERSITY OF IOWA</p> <p>DEPT OF PHYSICS & ASTRONOMY</p> <p>IOWA CITY, IOWA</p>	
		<p>LOCK-MALE</p>		<p>CODE IDENT NO. SIZE</p> <p>02542 A</p>	
<p>DO NOT SCALE PRINT</p> <p>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES WITH TOLERANCES ON: FRACTIONS DECIMALS ANGLES</p> <p>$\pm 1/32$ $.XX \pm .02$ $\pm 0^{\circ}15'$</p> <p>XXX $\pm .005$</p>		<p>DATE</p> <p>30 SEP 63</p> <p>10 DEC 63</p> <p>10 DEC 63</p> <p>10 DEC 63</p>		<p>SCALE 4/1</p> <p>WEIGHT</p> <p>SHEET / OF /</p>	
<p>MATERIAL</p> <p>TYPE A 286 STEEL</p>		<p>DESIGN ACTIVITY APPROVAL</p> <p>10 DEC 63</p>		<p>UNCLASSIFIED</p>	
<p>FINISH REQD</p> <p>SEE NOTES</p>		<p>OTHER ACTIVITY APPROVAL</p>			

DECLASSIFIED

[illegible]

6

UNCLASSIFIED

[illegible]

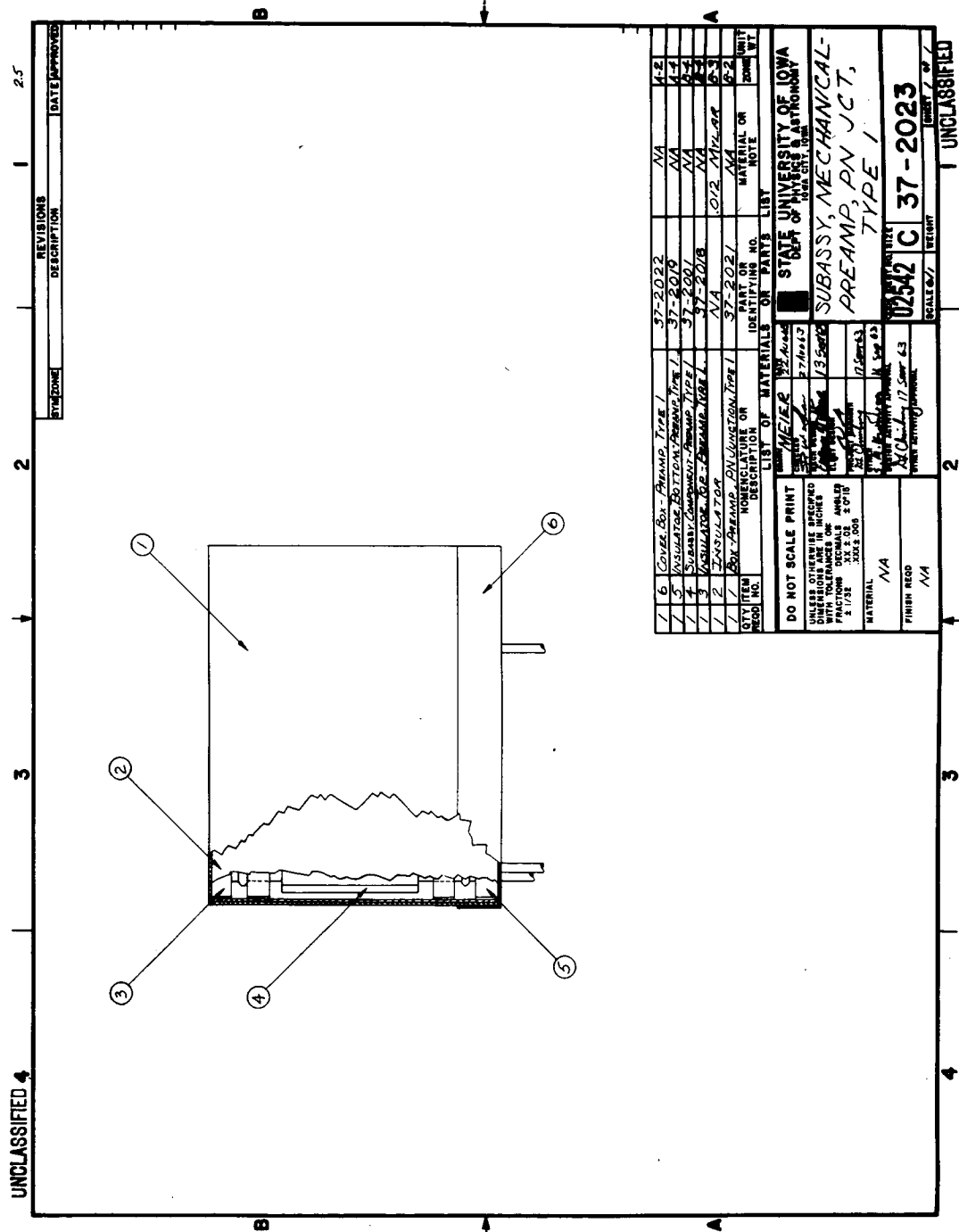
1. BIASING RESISTORS, ITEMS 13, 14, AND 15 TO B& D DETERMINED
NOTES: AT ASSY WITH INDIVIDUAL DETECTORS.

UNCLASSIFIED

5

QTY ITEM		NOMENCLATURE OR DESCRIPTION		PART OR IDENTIFYING NO.		MATERIAL OR NOTE		UNIT WT	
REVISIONS		SYMBOL		DESCRIPTION		DATE		APPROVED	
A		CHANGE DIMENSION FROM .560 TO .607		3 OCT 63					
<p>DO NOT SCALE PRINT</p> <p>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES WITH TOLERANCES ON: FRACTIONS DECIMALS ANGLES $\pm 1/32$.XX $\pm .02$ $\pm 0^\circ 15'$.XXX $\pm .005$</p> <p>MATERIAL COPPER</p> <p>FINISH REQ NA</p>									
<p>STATE UNIVERSITY OF IOWA DEPT OF PHYSICS & ASTRONOMY IOWA CITY, IOWA</p> <p>BOX - PREAMP, PN JCT, TYPE 1</p>									
<p>CODE IDENT NO. SIZE 02542 A 37-2021</p>									
<p>SCALE 2/1 WEIGHT SHEET / OF /</p>									

UNCLASSIFIED



45

0-40 DIA

SYN		REVISIONS	
DESCRIPTION		DATE APPROVED	
CHANGE DIMENSION FROM .612 TO .621		30 OCT 63	
12.9 DIA, 3 HOLE'S			

QTY	ITEM	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	MATERIAL OR NOTE	UNIT WT
LIST OF MATERIALS OR PARTS LIST					
DO NOT SCALE PRINT					
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES WITH TOLERANCES ON FRACTIONS DECIMALS ANGLES $\pm 1/32$ $.XX \pm .02$ ± 0.15 $.XXX \pm .005$					
MATERIAL COPPER					
FINISH REQD NA					

DRAWN M/LEK		DATE 22 AUG 63	
CHECKED	26 AUG 63		
MECH DESIGN			
ELECT DESIGN			
PROJECT MANAGER	30 OCT 63		
OTHER	30 OCT 63		
DESIGN ACTIVITY APPROVAL			
30 OCT 63			
OTHER ACTIVITY APPROVAL			

CODE IDENT NO.	SIZE	WEIGHT	SHEET / OF
A	37-2022		1

5

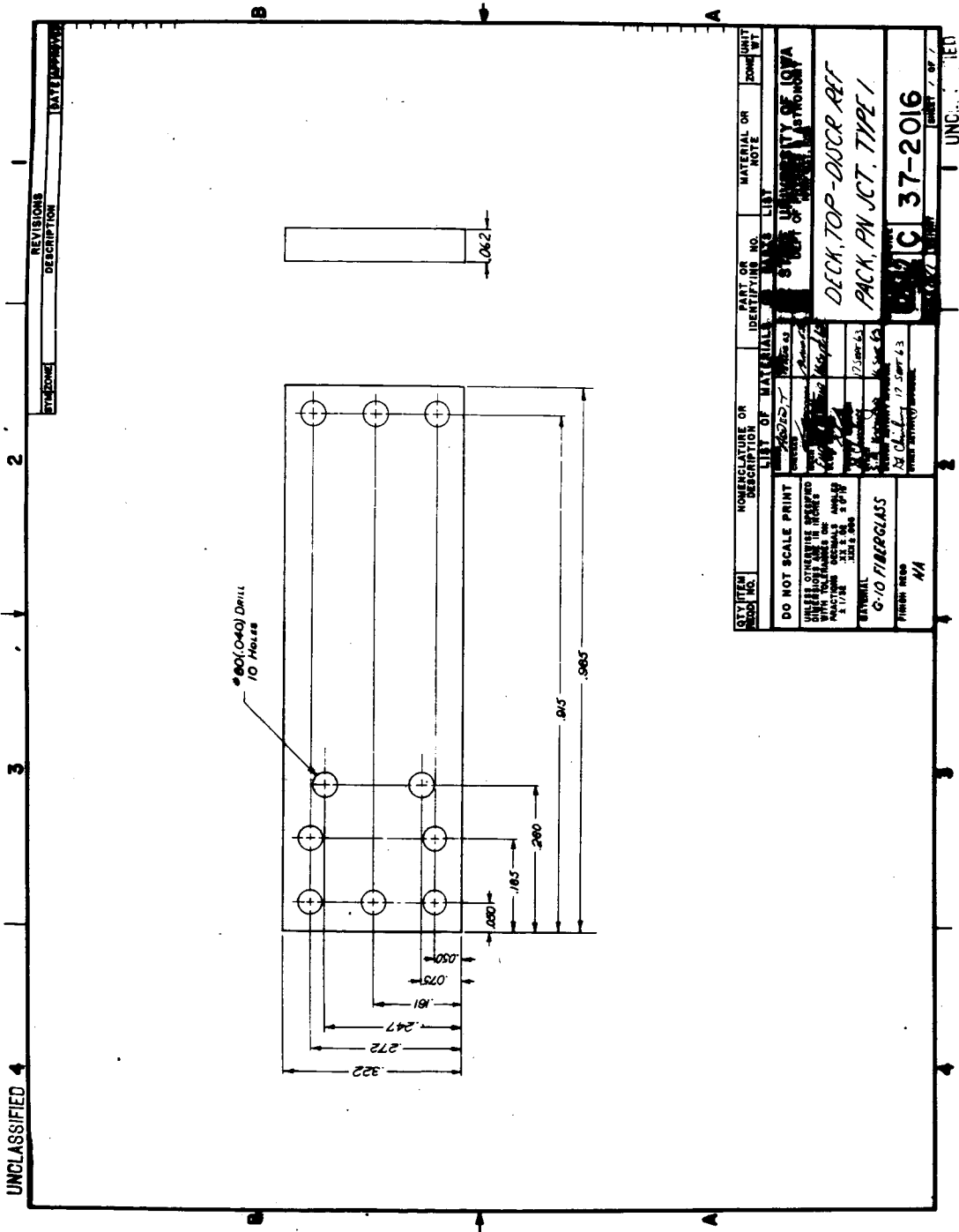
UNCLASSIFIED		REVISIONS		DATE APPROVED
		SYMBOL	DESCRIPTION	
		STATE UNIVERSITY OF IOWA DEPT OF PHYSICS & ASTRONOMY IOWA CITY, IOWA		
		INSULATOR, TOP- PREAMP, PN JUNCTION, TYPE 1		
QTY ITEM REQD NO.	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	MATERIAL OR NOTE	UNIT WT
LIST OF MATERIALS OR PARTS LIST				
DO NOT SCALE. PRINT		DRAWN MEIER	DATE 22 AUG 63	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES WITH TOLERANCES ON: FRACTIONS DECIMALS ANGLES ± 1/32 .XX ± .02 ± 0°15' .XXX ± .005		CHECKED SD W. Schaefer	DATE 26 AUG 63	
MATERIAL FIBERGLASS		MECH DESIGN Eugene W. Schaefer	DATE 15 SEP 63	
FINISH REQD N/A		ELECT DESIGN [Signature]		
		PROJECT MANAGER [Signature]	DATE 17 SEP 63	
		OTHER [Signature]	DATE 16 SEP 63	
		DESIGN ACTIVITY APPROVAL [Signature]	DATE 17 SEP 63	
		OTHER ACTIVITY APPROVAL		
CODE IDENT NO. SIZE		02542 A 37-2018		
SCALE 2/1		SHEET 1 OF 1		
UNCLASSIFIED				

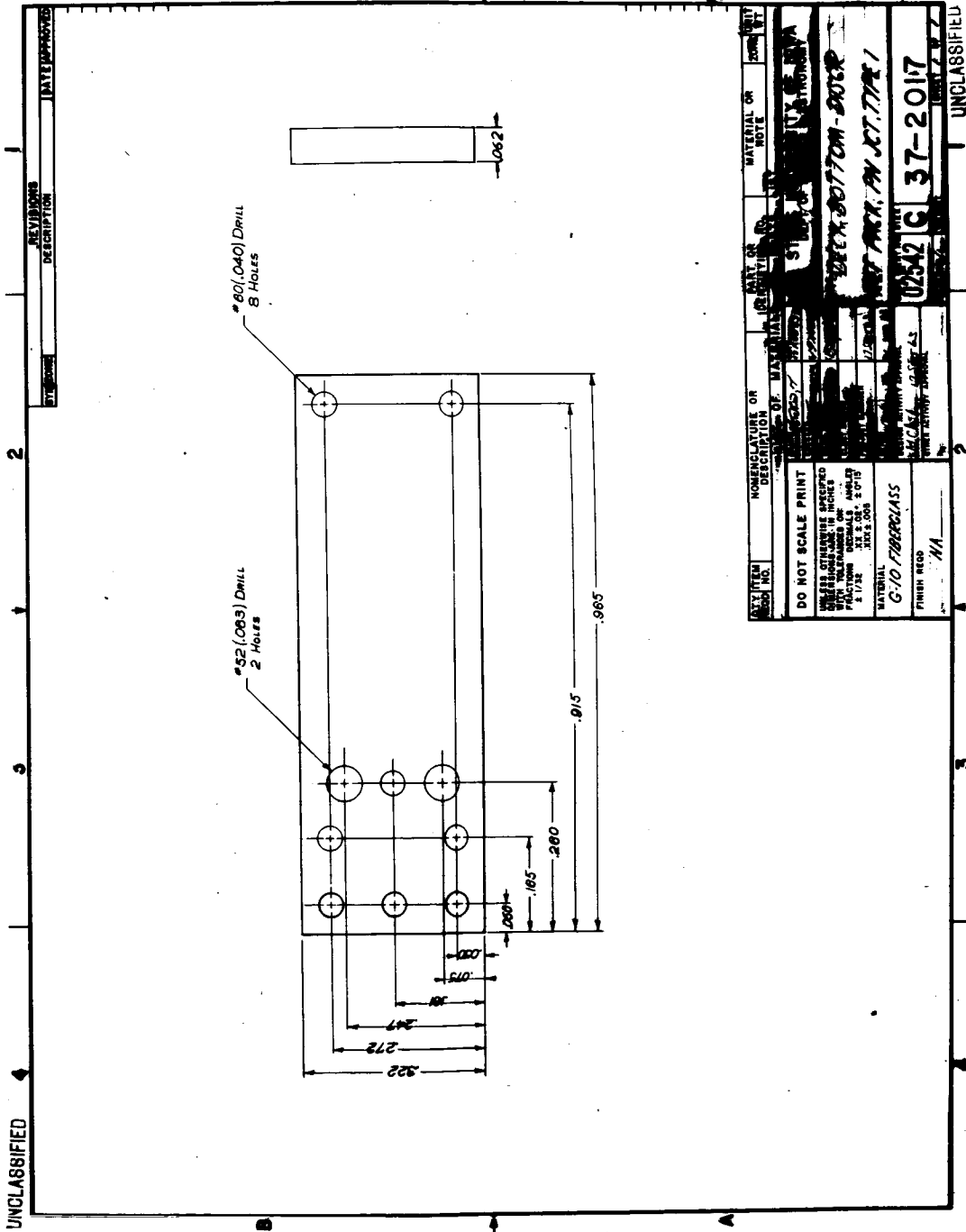
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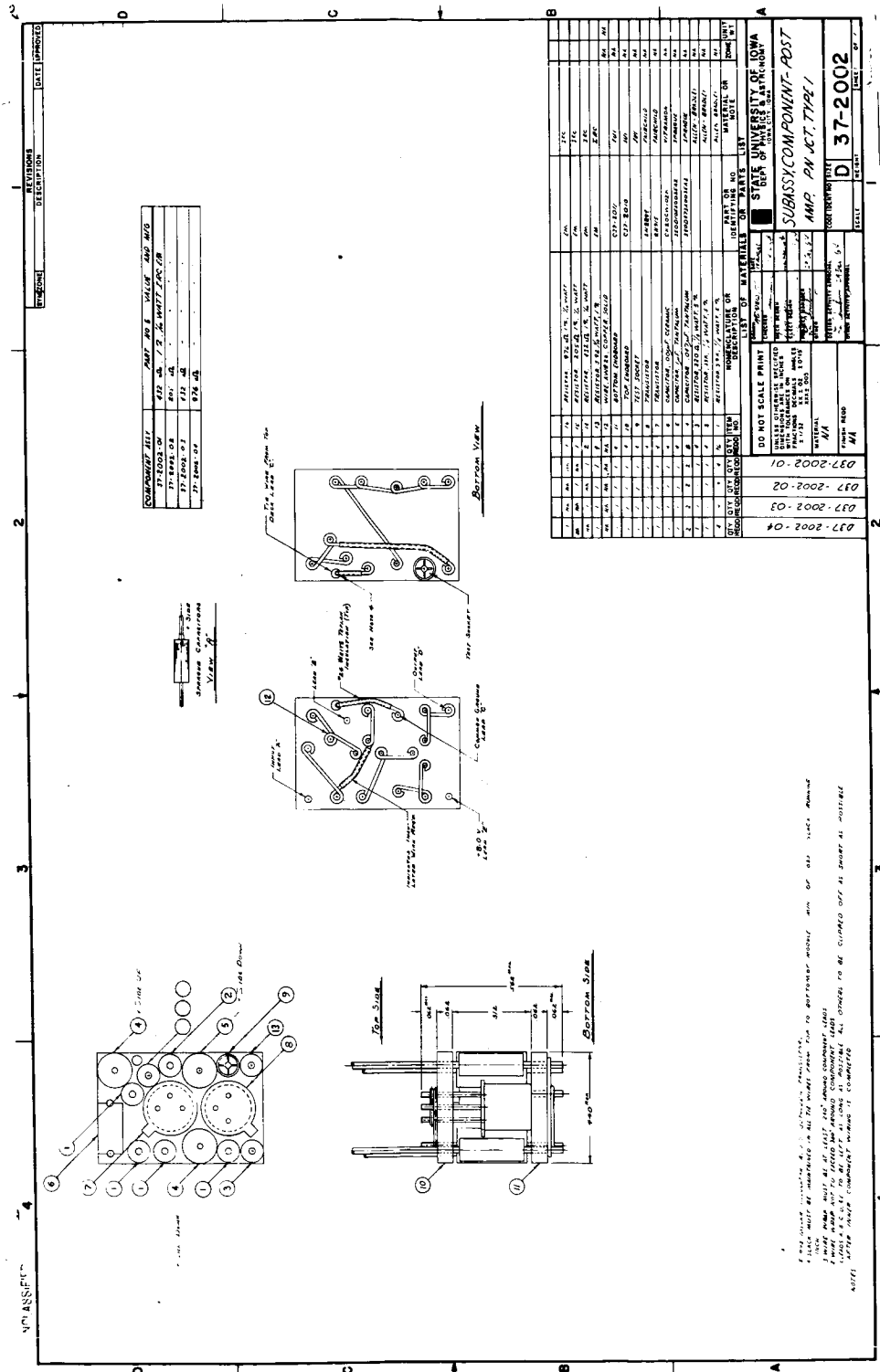
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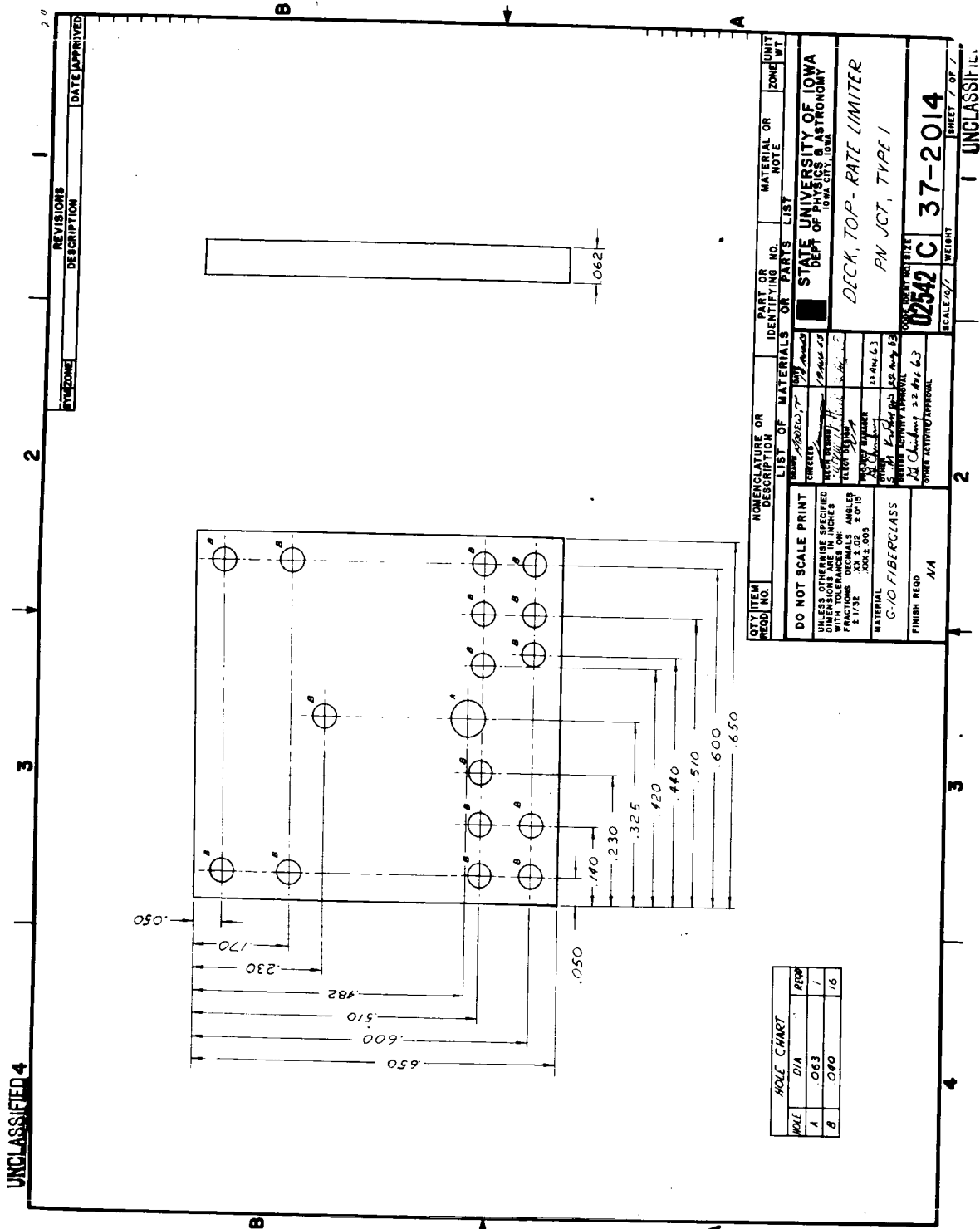
SYN		REVISIONS		DATE APPROVED	
DESCRIPTION					
QTY REQD		ITEM NO.		UNIT WT	
NOMENCLATURE OR DESCRIPTION		PART OR IDENTIFYING NO.		MATERIAL OR NOTE	
LIST OF MATERIALS OR PARTS LIST					
DRAWN MEIER		DATE 22 Aug 63		STATE UNIVERSITY OF IOWA	
CHECKED D.W. Shaw		26 Aug 63		DEPT OF PHYSICS & ASTRONOMY	
MECH DESIGN		13 Sept 63		IOWA CITY, IOWA	
ELECT DESIGN		NA		INSULATOR, BOTTOM-	
PROJECT MANAGER		17 Sept 63		PREAMP, PN JUNCTION	
OTHER		16 Sept 63		TYPE 1	
DESIGN ACTIVITY APPROVAL		17 Sept 63		CODE IDENT NO. SIZE	
DATE 17 Sept 63		17 Sept 63		02542 A 37-2019	
OTHER ACTIVITY APPROVAL				SCALE 2/1	
FINISH REQD		N/A		SHEET / OF /	
				UNCLASSIFIED	

UNCLASSIFIED		2		1		REVISIONS		DATE APPROVED	
SYM/ZONE		DESCRIPTION		PART OR IDENTIFYING NO.		MATERIAL OR NOTE		UNIT	
UNCLASSIFIED		2		1		STATE UNIVERSITY OF IOWA DEPT OF PHYSICS & ASTRONOMY IOWA CITY, IOWA		UNIT	
UNCLASSIFIED		2		1		DISCRIMINATOR, REFERENCE PN JUNCTION, TYPE I		UNIT	
UNCLASSIFIED		2		1		CODE IDENT NO. SIZE 02542 B 37-3006		UNIT	
UNCLASSIFIED		2		1		SCALE NA WEIGHT NA SHEET 1 OF 1		UNCLASSIFIED	
UNCLASSIFIED		2		1		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES FRACTIONS DECIMALS ANGLES ± 1/32 ± 0.005 ± 0°15		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES FRACTIONS DECIMALS ANGLES ± 1/32 ± 0.005 ± 0°15	
UNCLASSIFIED		2		1		MATERIAL NA		FINISH REQ NA	
UNCLASSIFIED		2		1		3. ALL DIODES ARE FD295 UNLESS OTHERWISE SPECIFIED. 2. ALL CAPACITANCE VALUES IN P-FILES UNLESS OTHERWISE SPECIFIED. 1. ALL RESISTANCE VALUES IN OHMS. NOTES:		3. ALL DIODES ARE FD295 UNLESS OTHERWISE SPECIFIED. 2. ALL CAPACITANCE VALUES IN P-FILES UNLESS OTHERWISE SPECIFIED. 1. ALL RESISTANCE VALUES IN OHMS. NOTES:	
UNCLASSIFIED		2		1					

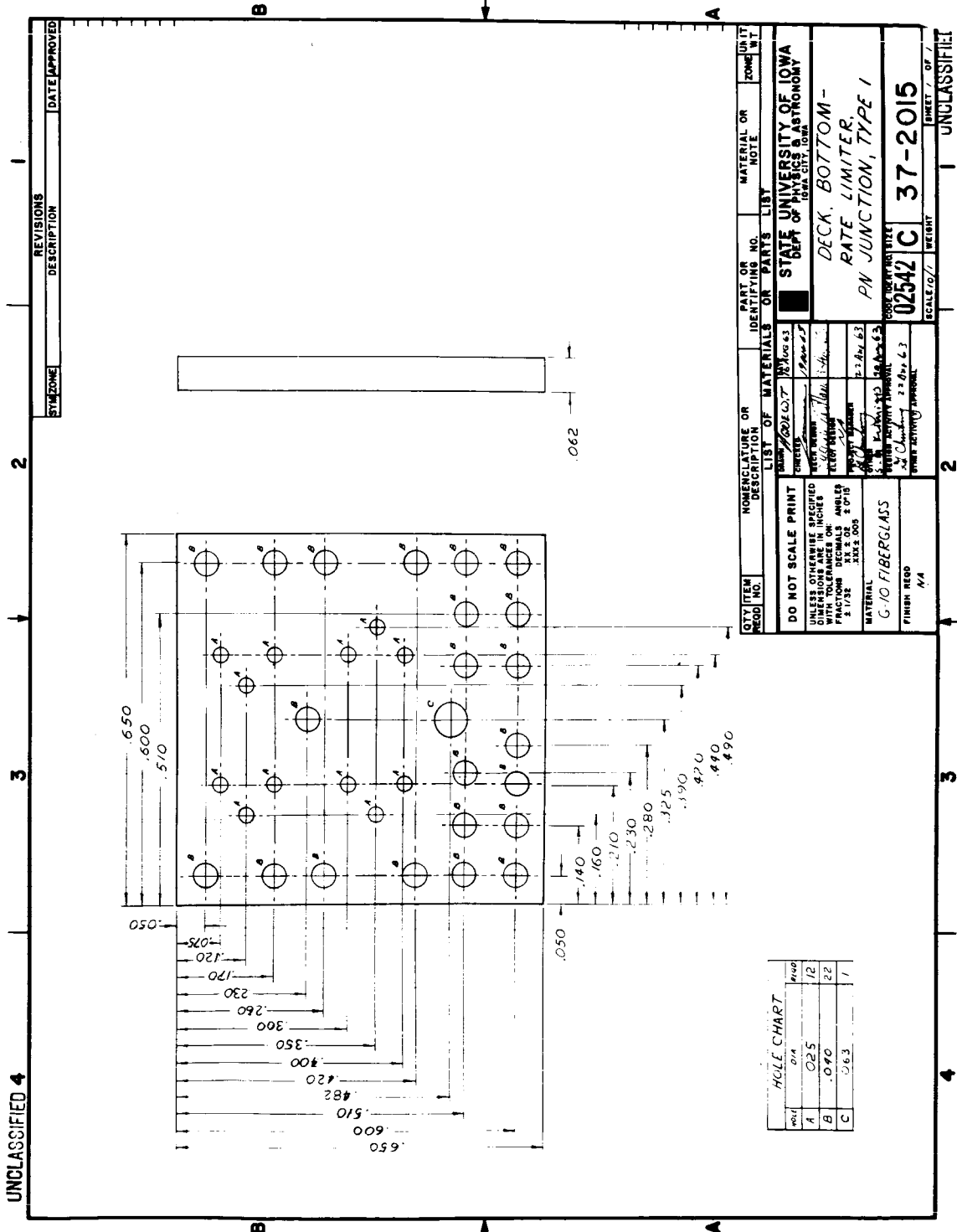


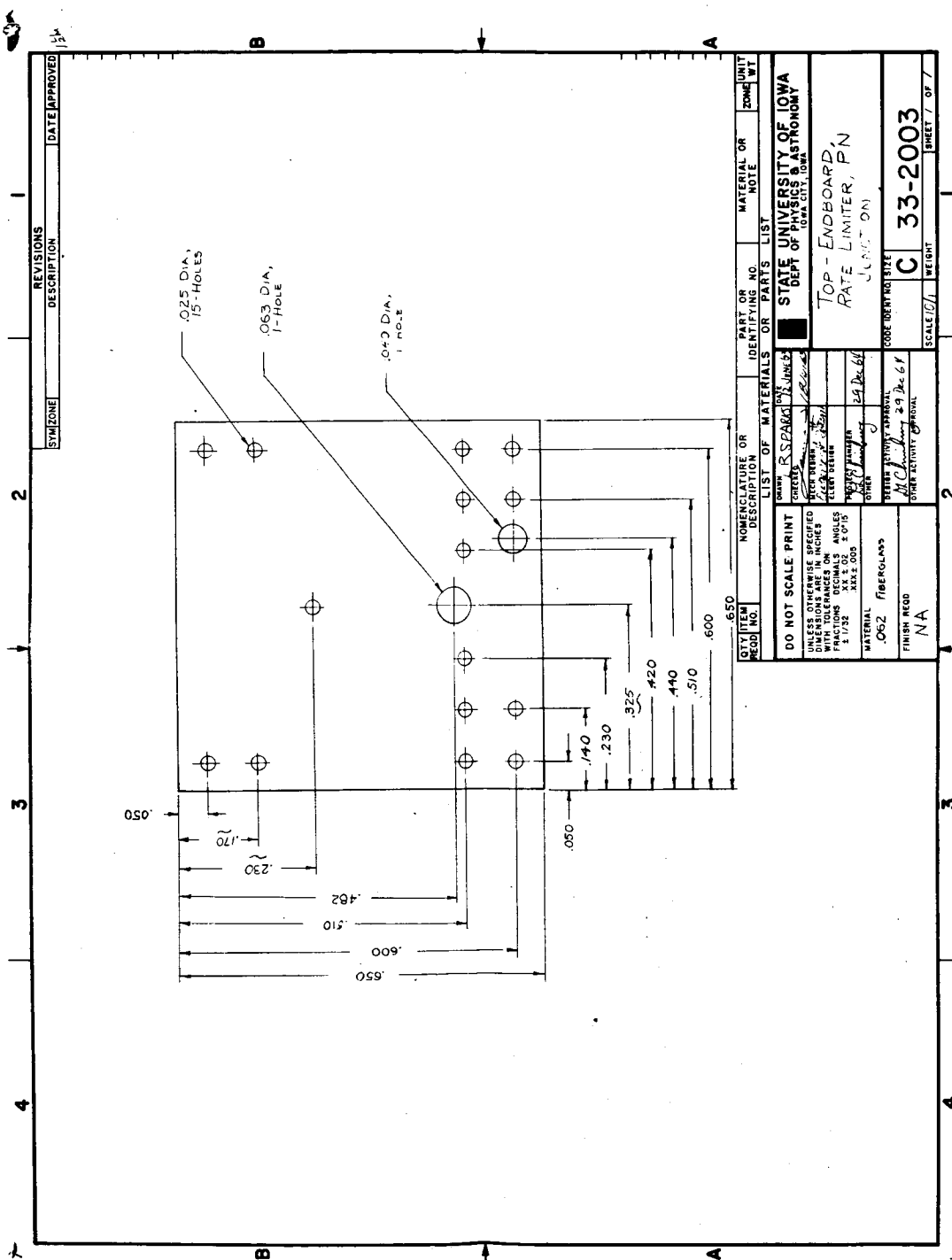


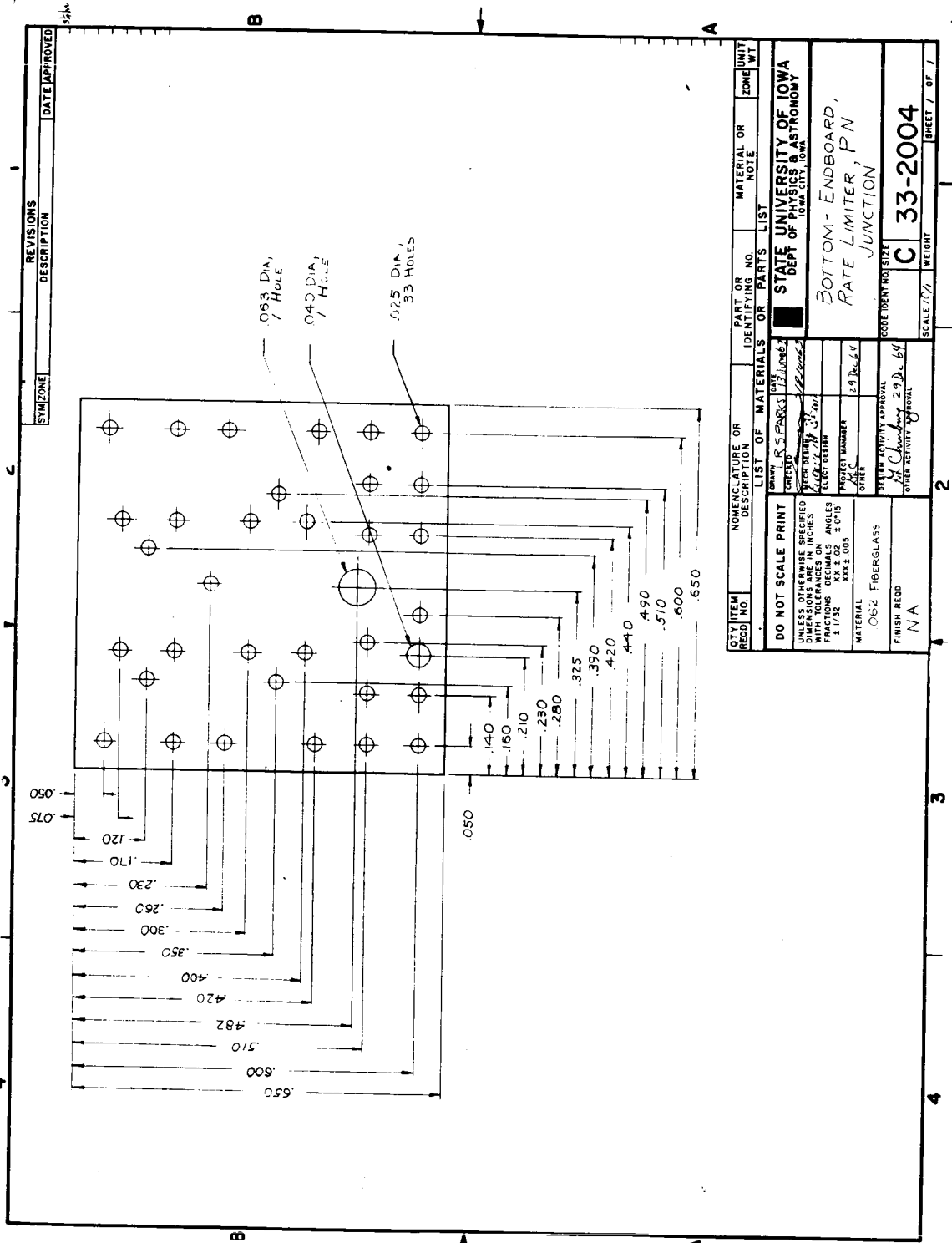




HOLE CHART		
NO.	DIA	REQD
1	0.63	1
2	0.40	16



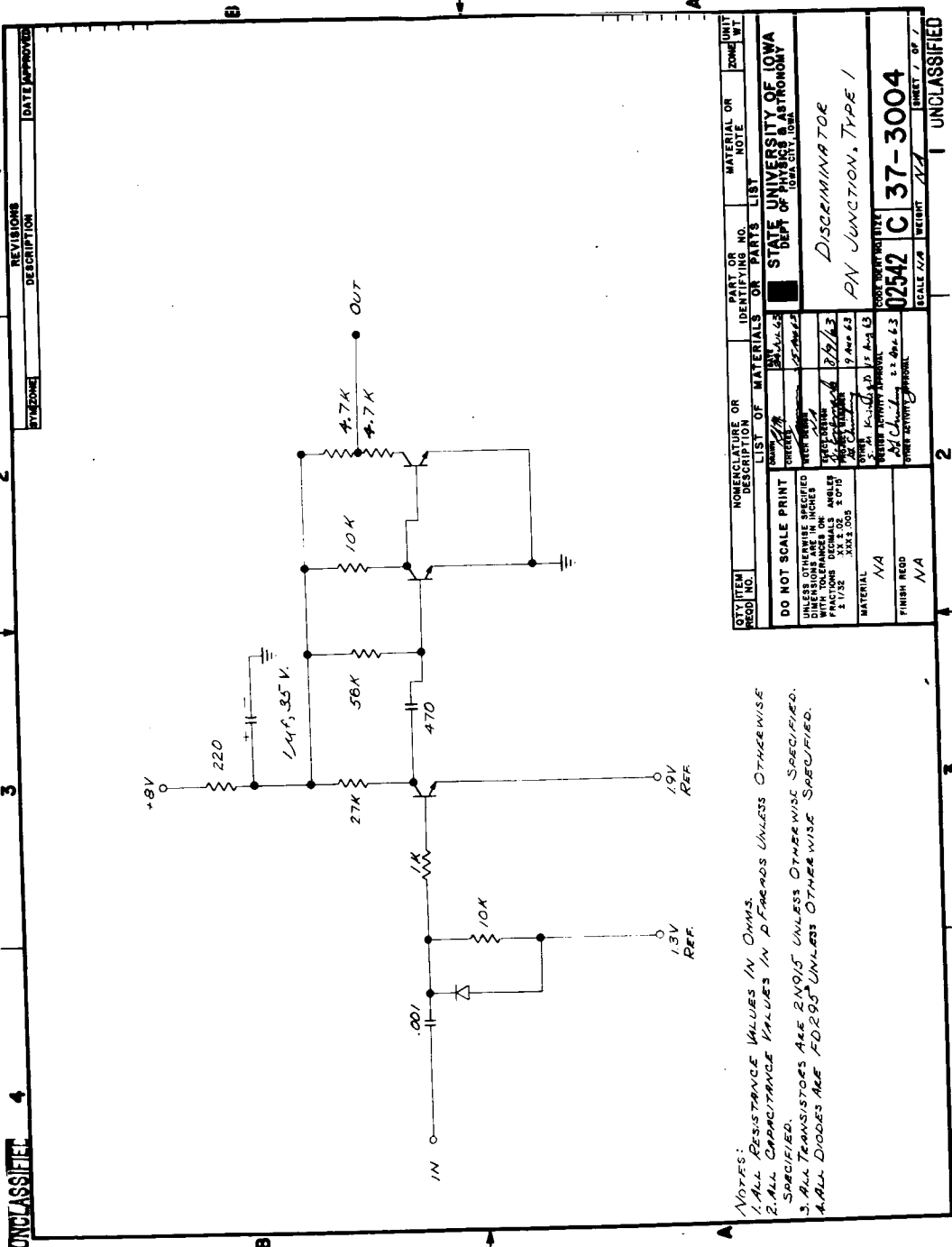




SYMBOL	REVISIONS	DATE APPROVED
	DESCRIPTION	

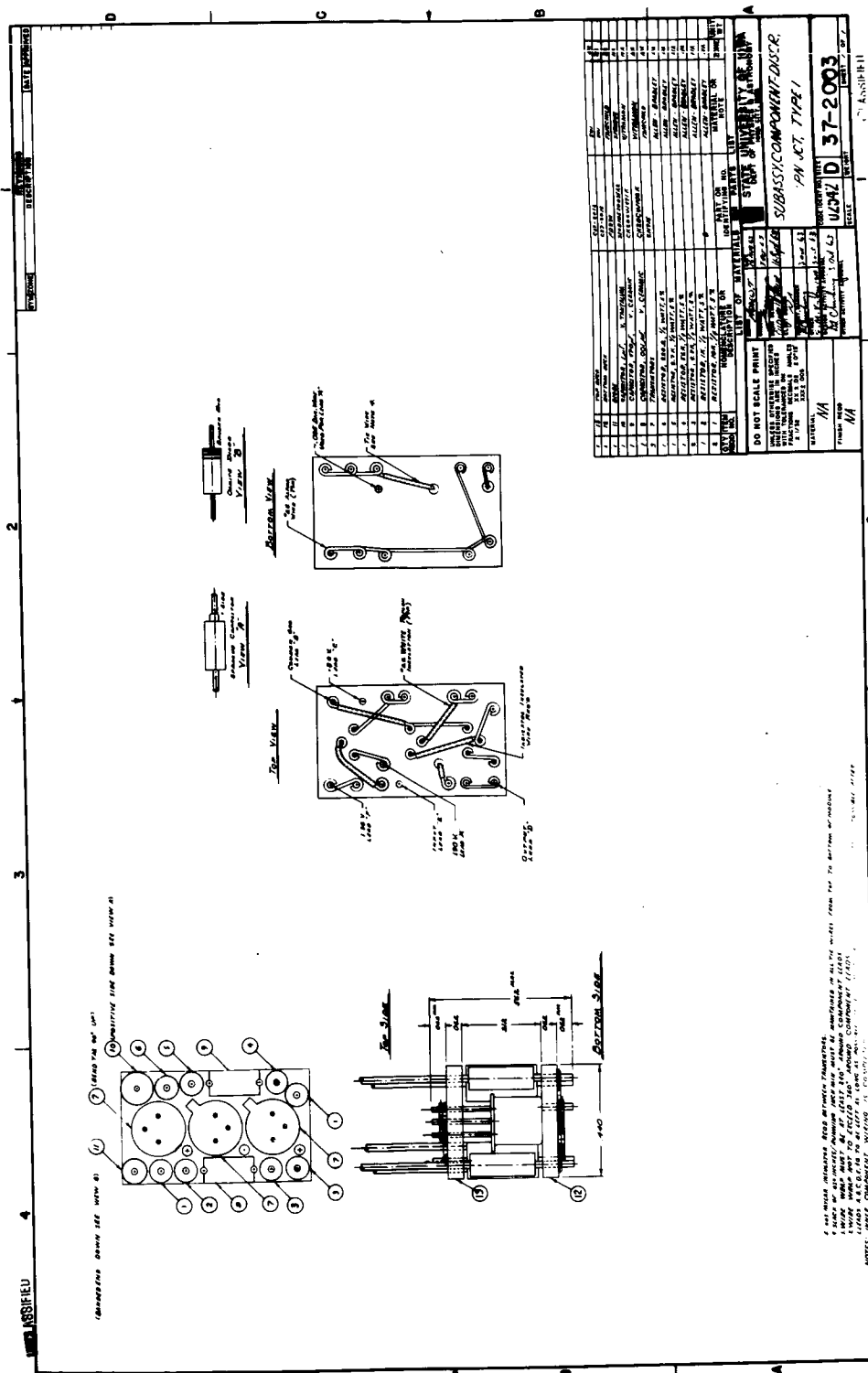
QTY / ITEM	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	MATERIAL OR NOTE	UNIT
RECD NO.				ZONE
<p>DO NOT SCALE PRINT</p> <p>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES</p> <p>FRACTIONS DECIMALS ANGLES</p> <p>1/32 1/16 1/8 1/4 1/2 3/4 1 1 1/2 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100</p>				
<p>STATE UNIVERSITY OF IOWA</p> <p>DEPT. OF PHYSICS & ASTRONOMY</p> <p>STATE OF IOWA CITY, IOWA</p> <p>BOTTOM- ENDBOARD,</p> <p>RATE LIMITER, P.N.</p> <p>JUNCTION</p>				
<p>062 FIBERGLASS</p> <p>FINISH REQD</p> <p>NA</p>				
<p>SCALE: 1/2" = 1"</p> <p>WEIGHT</p> <p>SHEET 1 OF 1</p>				

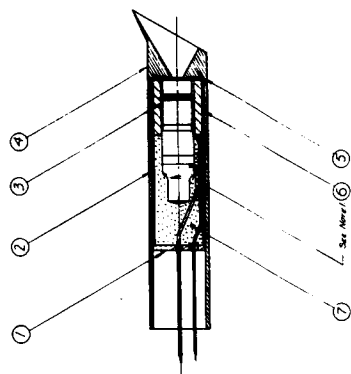
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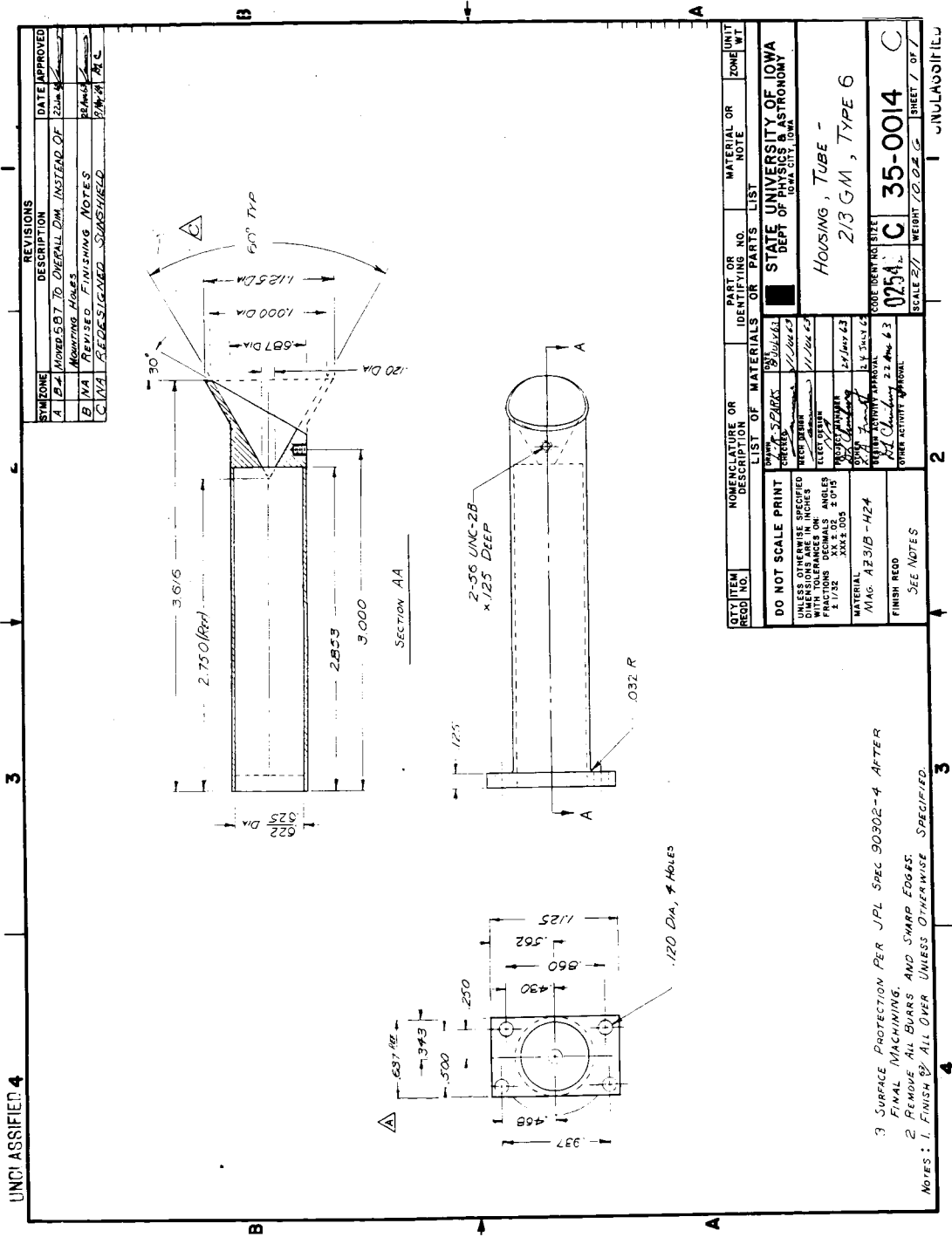


NOTES:
 1. ALL RESISTANCE VALUES IN OHMS.
 2. ALL CAPACITANCE VALUES IN P-FARADS UNLESS OTHERWISE SPECIFIED.
 3. ALL TRANSISTORS ARE 2N4015 UNLESS OTHERWISE SPECIFIED.
 4. ALL DIODES ARE FD295 UNLESS OTHERWISE SPECIFIED.

UNCLASSIFIED		1.0	
REVISIONS		DATE APPROVED	
DESCRIPTION			
SYMBOLOGY			
NOMENCLATURE OR DESCRIPTION		PART OR IDENTIFYING NO.	MATERIAL OR UNIT
LIST OF MATERIALS		LIST	ZONE
DO NOT SCALE PRINT		STATE UNIVERSITY OF IOWA	
UNLESS OTHERWISE SPECIFIED		DEPT. OF ASTRONOMY	
DIMENSIONS ARE IN INCHES		IOWA CITY, IOWA	
FRACTIONS ARE IN DECIMALS		DISCRIMINATOR	
UNLESS OTHERWISE SPECIFIED		P-N JUNCTION, TYPE 1	
MATERIAL		Q2542	C 37-3004
FINISH REQD		SCALE 1/4"	SHEET 1 OF 1
OTHER ACTIVITY		UNCLASSIFIED	



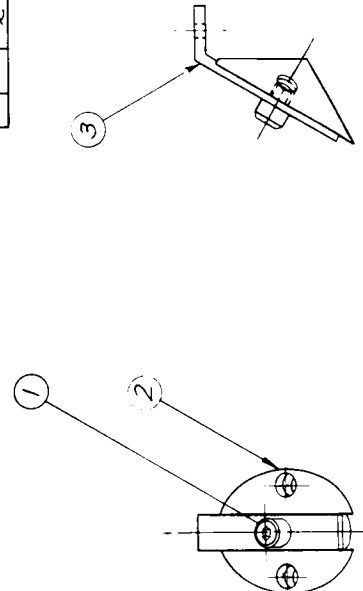




		REVISIONS DESCRIPTION DATE APPROVED	
UNCLASSIFIED		2	
UNCLASSIFIED		2	

QTY	ITEM	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	MATERIAL OR NOTE	UNIT
LIST OF MATERIALS OR PARTS LIST					
DO NOT SCALE PRINT		STATE UNIVERSITY OF IOWA DEPT OF PHYSICS & ASTRONOMY IOWA CITY, IOWA			
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES FRACTIONS DECIMALS ANGLES ± 1/32 .XX ± .02 ± 0°15' .XXX ± .005		SPACER, FRONT - 2/3 GM, TYPE 6			
MATERIAL TEFLON		CONE HOLE SIZE 02542 B 35-0013			
FINISH REQD NA		SCALE 4/1 WEIGHT .50 g SHEET 1 OF 1			

SYMBOL		REVISIONS		DATE APPROVED	
A		DESCRIPTION		21 OCT 63	
A		CHANGED SIZE OF IDEAS 2 & 3 (WENT OUT OF SCALE)			

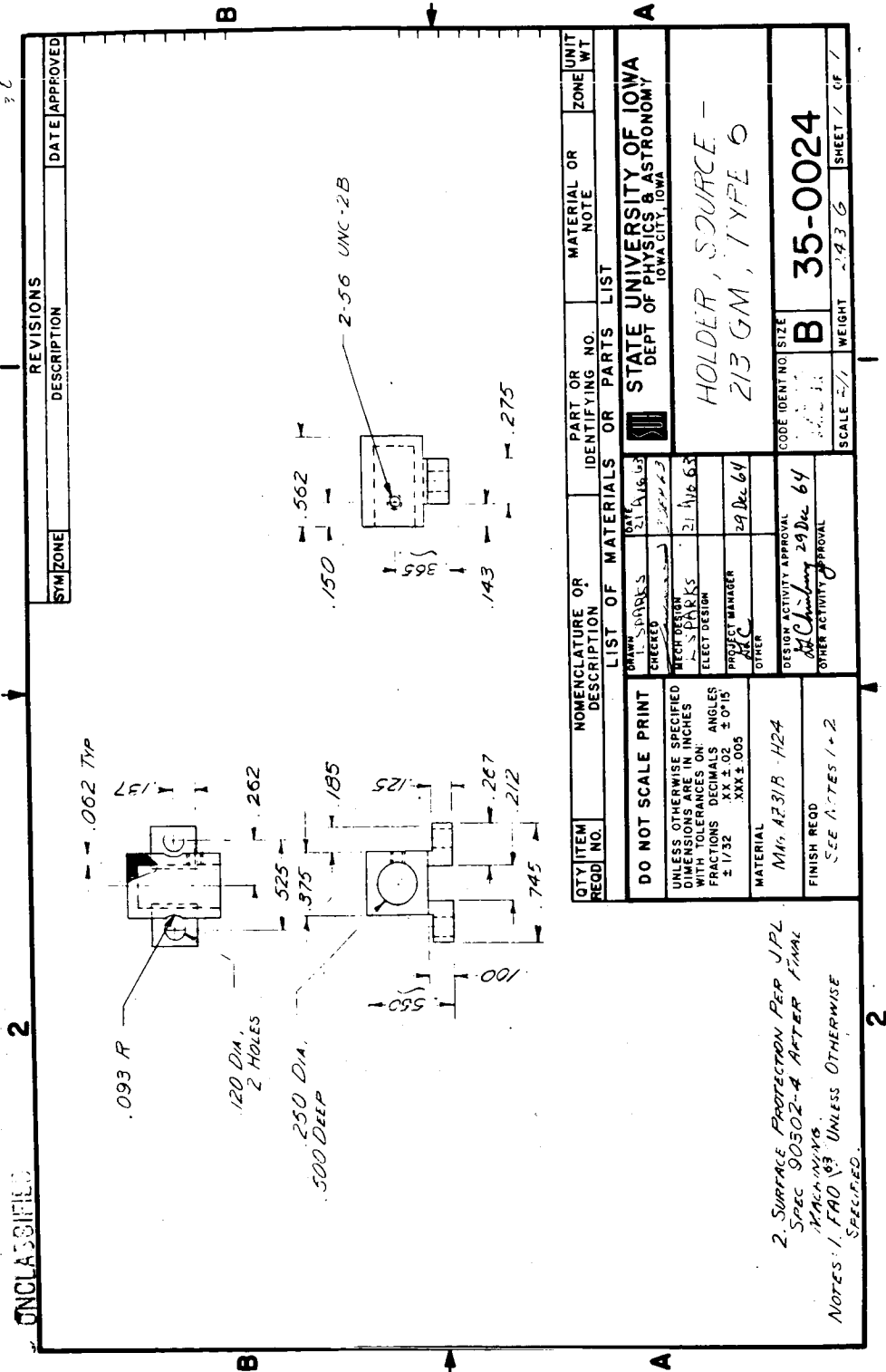


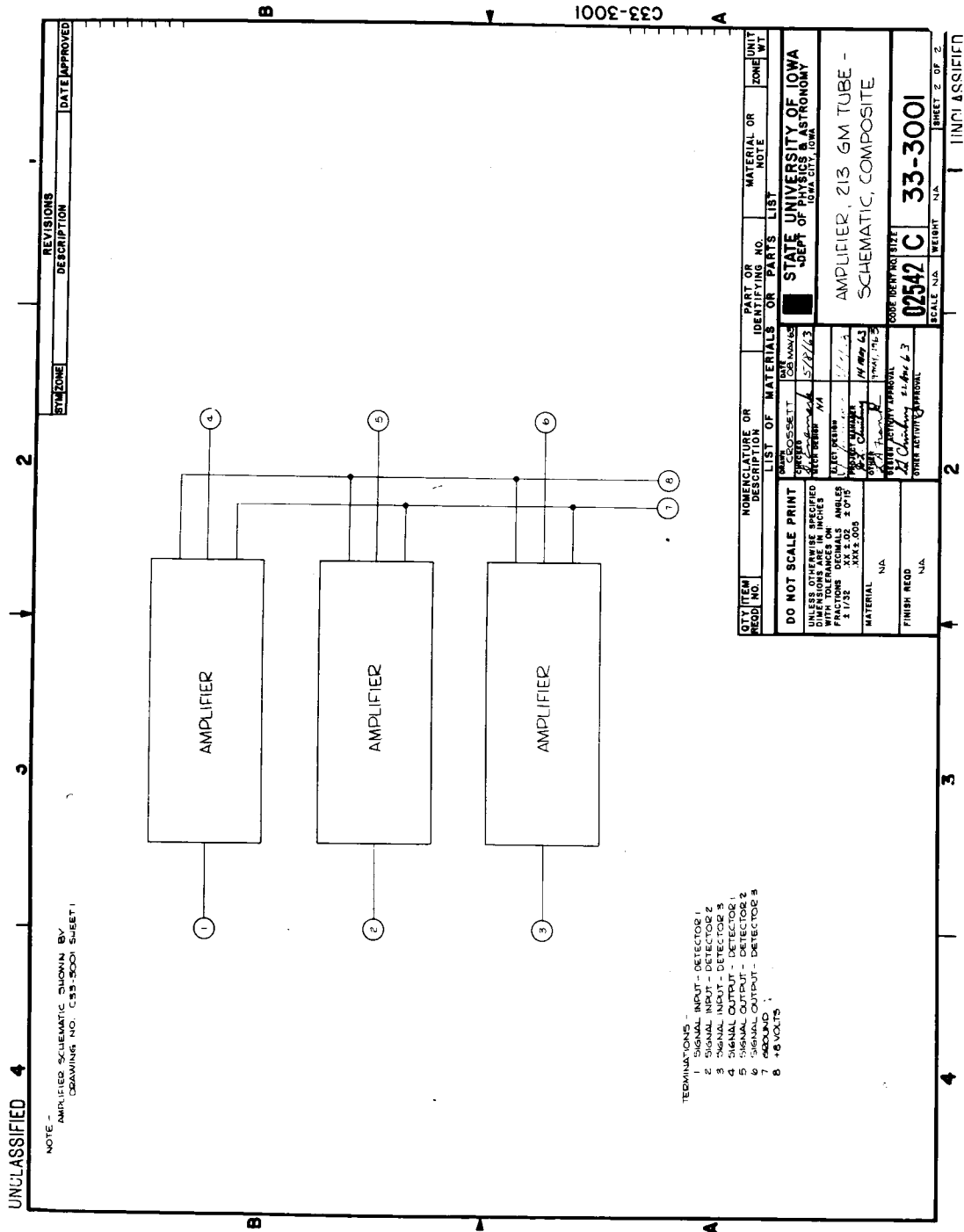
QTY	ITEM	DESCRIPTION	PART OR IDENTIFYING NO.	MATERIAL OR NOTE	UNIT	ZONE	WT
1	3	BRACKET, CAP - 213 GM TYPE 0	B 35-0016	NA	NA	21	
1	2	CAP, PROTECTIVE - TYPE 0	B 35-0015	NA	NA	21	
1	1	SCREW, ALLEN HEAD	4-40 UNC-2A x .250	ALLEN MFG CO	NA	90	

DO NOT SCALE PRINT		LIST OF MATERIALS OR PARTS LIST	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES WITH TOLERANCES ON: FRACTIONS DECIMALS ANGLES XX ± .02 ± 0°15' XXX ± .005		DRAWN BY: SPARKS CHECKED BY: J. SPARKS TECH DESIGN BY: J. SPARKS ELECT DESIGN BY: J. SPARKS PROJECT MANAGER BY: J. SPARKS OTHER BY: J. SPARKS DESIGN ACTIVITY APPROVAL BY: J. SPARKS OTHER ACTIVITY APPROVAL BY: J. SPARKS	

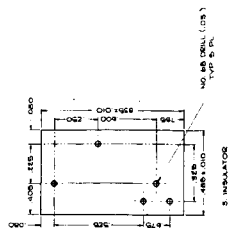
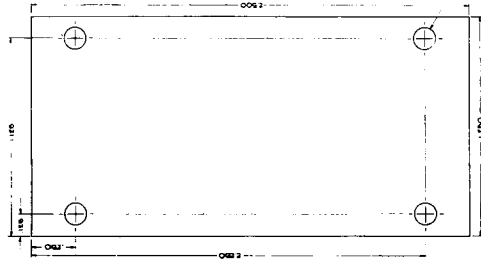
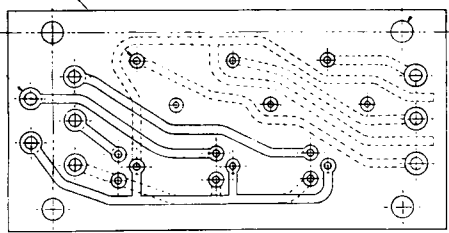
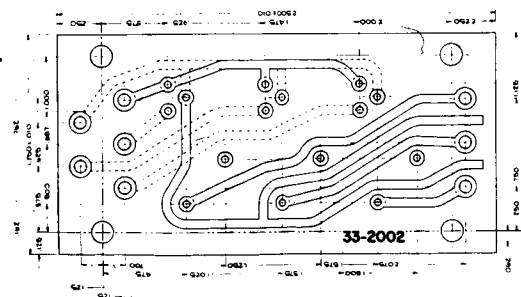
STATE UNIVERSITY OF IOWA DEPT OF PHYSICS & ASTRONOMY IOWA CITY, IOWA	
SUBASSY, CAP, PROTECTIVE - 213 GM, TYPE 0	
CODE IDENT NO. SIZE 02342 B	35-0023
SCALE 2/1	WEIGHT 374 G
SHEET 1 OF 1	

CLASSIFICATION		2																																	
<div style="text-align: center;"> </div>	<div style="text-align: center;"> </div>	<div style="text-align: center;"> </div>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2" style="text-align: center;">REVISIONS</th> <th style="text-align: center;">DATE APPROVED</th> </tr> <tr> <th style="text-align: center;">SYM</th> <th style="text-align: center;">DESCRIPTION</th> <th style="text-align: center;">DATE</th> </tr> <tr> <td style="text-align: center;">A</td> <td>CHANGED .975 TO .925 AND ADD .135 & .545</td> <td style="text-align: center;">8/10/67</td> </tr> </table>	REVISIONS		DATE APPROVED	SYM	DESCRIPTION	DATE	A	CHANGED .975 TO .925 AND ADD .135 & .545	8/10/67																							
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<p>2. SURFACE PROTECTION PER JPL SPEC 90502-4 AFTER FINAL MACHINING.</p> <p>NOTES: 1. FAO 63 UNLESS OTHERWISE SPECIFIED.</p>																																			





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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466
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1

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SYMBOL		REVISIONS			
		DESCRIPTION	DATE APPROVED		
8	NA	TERMINAL, FORKED, GOLD PLATED	33-2002-4	LERCO X-5075-B	
1	NA	INSULATOR	33-2002-3	REF. D33-2002 SHEET 3	
3	NA	INSULATOR	33-2002-2	REF. D33-2002 SHEET 3	
1	NA	MOTHER BOARD	33-2002-1	REF. D33-2002 SHEET 3	
QTY REQD	ITEM NO.	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	MATERIAL OR NOTE	UNIT WT

LIST OF MATERIALS OR PARTS LIST	
DO NOT SCALE PRINT	DATE 06 JUN 63
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES WITH TOLERANCES ON: FRACTIONS DECIMALS ANGLES $\pm 1/32$.XX $\pm .02$ $\pm 0^{\circ}15'$.XXX $\pm .005$	CHECKED <i>[Signature]</i> 10 JUN 63
MATERIAL	MECH DESIGN NA
NA	ELECT DESIGN <i>[Signature]</i> 6/10/63
FINISH REQD	PROJECT MANAGER <i>[Signature]</i> 10 JUN 1963
NA	OTHER <i>[Signature]</i> NA
	DESIGN ACTIVITY APPROVAL <i>[Signature]</i> 22 Aug 63
	OTHER ACTIVITY APPROVAL <i>[Signature]</i>

STATE UNIVERSITY OF IOWA DEPT OF PHYSICS & ASTRONOMY IOWA CITY, IOWA	
AMPLIFIER ASSEMBLY, 213 GM TUBE - MATERIALS	
CODE IDENT NO. SIZE	72542 A
SCALE NA	LM33-2002
WEIGHT	SHEET 1 OF 3

UNCLASSIFIED

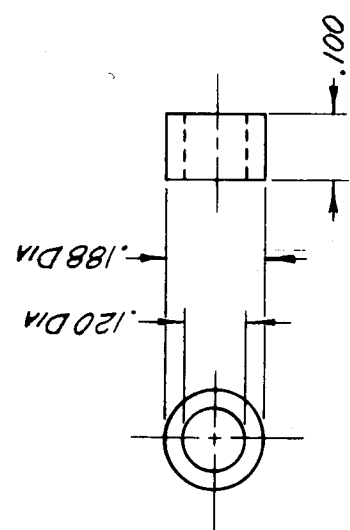
UNCLASSIFIED

2

SYN/ZONE		REVISIONS		DATE APPROVED	
		DESCRIPTION			
1	17	ENDBOARD, BOTTOM SIDE, TOP LAYER	33-2001-17	REF. D53-2001 SHEET 2	NA
1	16	ENDBOARD, BOTTOM SIDE, BOTTOM LAYER	33-2001-16	REF. D53-2001 SHEET 2	NA
1	15	ENDBOARD, TOP SIDE, BOTTOM LAYER	33-2001-15	REF. D53-2001 SHEET 2	NA
1	14	ENDBOARD, TOP SIDE, TOP LAYER	33-2001-14	REF. D53-2001 SHEET 2	NA
NA	13	WIPE, AN6 22, COPPER, SOLID	33-2001-13		NA
1	12	CAPACITOR, 3.3 μ F, 15V TANTALUM	33-2001-12	SPRAGUE 59003320015A2	NA
1	11	CAPACITOR, 220 pF, 200V CERAMIC	33-2001-11	VITRAMON CROSCONZELK	NA
1	10	RESISTOR, 1M, 1/4 WATT, 5%	33-2001-10	ALLEN-BRADLEY	NA
2	9	RESISTOR, 100K, 1/4 WATT, 5%	33-2001-9	ALLEN-BRADLEY	NA
1	8	RESISTOR, 18K, 1/4 WATT, 5%	33-2001-8	ALLEN-BRADLEY	NA
2	7	RESISTOR, 10K, 1/4 WATT, 5%	33-2001-7	ALLEN-BRADLEY	NA
2	6	RESISTOR, 47K, 1/4 WATT, 5%	33-2001-6	ALLEN-BRADLEY	NA
1	5	RESISTOR, 510 Ω , 1/4 WATT, 5%	33-2001-5	ALLEN-BRADLEY	NA
1	4	RESISTOR, 100 Ω , 1/4 WATT, 5%	33-2001-4	ALLEN-BRADLEY	NA
1	3	DIODE	33-2001-3	FAIRCHILD 1D295	NA
2	2	TRANSISTOR	33-2001-2	MOTOROLA 2N2222	NA
1	1	TRANSISTOR	33-2001-1	FAIRCHILD 2N995	NA
QTY	ITEM	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	MATERIAL OR NOTE	UNIT
REQD	NO.				ZONE WT
LIST OF MATERIALS OR PARTS LIST					
DO NOT SCALE PRINT					
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES WITH TOLERANCES ON: FRACTIONS DECIMALS ANGLES .XX \pm .02 \pm 0°15' .XXX \pm .005					
MATERIAL					
NA					
FINISH REQD					
NA					
STATE UNIVERSITY OF IOWA DEPT. OF PHYSICS & ASTRONOMY					
AMPLIFIER, 213 GM TUBE - LIST OF MATERIALS					
CODE IDENT NUMBER					
02542 B LM33-2001					
SCALE NA WEIGHT					
SHEET 1 OF 3					
UNCLASSIFIED					

BLM33-2001

UNCLASSIFIED

SYN		REVISIONS		DATE APPROVED	
DESCRIPTION		DESCRIPTION		DATE APPROVED	
<div></div>					
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QTY	ITEM	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	MATERIAL OR NOTE	UNIT WT
DO NOT SCALE PRINT					
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES WITH TOLERANCES ON: FRACTIONS DECIMALS ANGLES ± 1/32 .XX ± .02 ± .015 .XXX ± .006					
MATERIAL		MAG AZ31B-H24			
FINISH REQD		63 ✓			
DRAWN SHAW, D.W.		13 AUG '63			
CHECKED		19 AUG '63			
DESIGN SHAW, D.W.		15 AUG '63			
ELECT DESIGN		22 AUG '63			
PROJECT MANAGER		19 AUG '63			
OTHER		CROSSETT			
DESIGN ACTIVITY APPROVAL		22 Aug 63			
OTHER ACTIVITY APPROVAL		22 Aug 63			
CODE IDENT NO		SIZE			
02542		A			
SCALE 4/1		WEIGHT			
SHEET 4/1		SHEET / OF /			
33-0004		UNCLASSIFIED			

STATE UNIVERSITY OF IOWA
DEPT OF PHYSICS & ASTRONOMY
IOWA CITY, IOWA

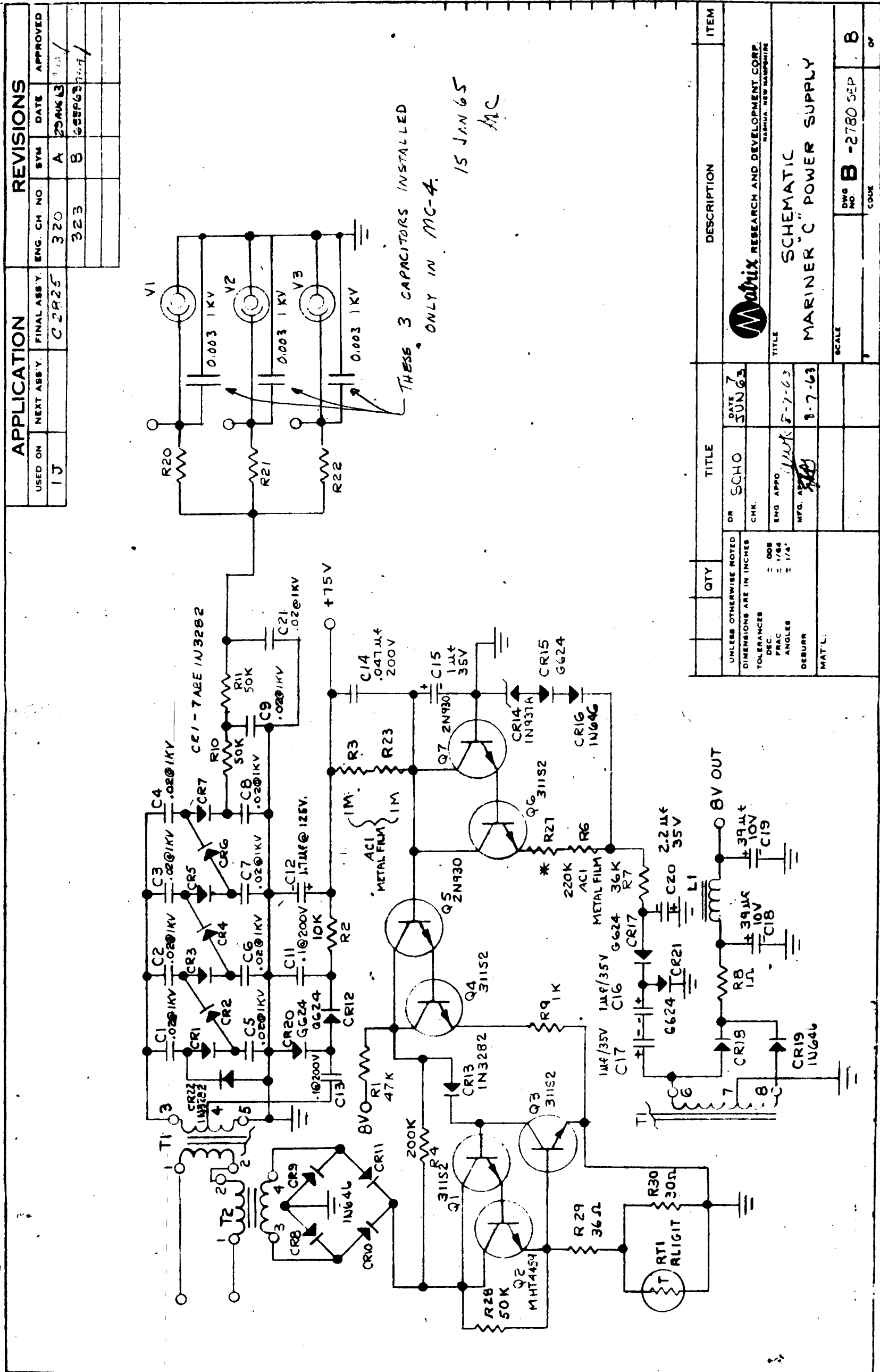
SPACER, ELECTRONICS-
UNIT 25

SYMBOL		REVISIONS		DATE APPROVED
		DESCRIPTION	CHG TERM. LOCATIONS & ADDED	
A		A-2	TERMINALS & CNG TITLE	5/1/65


NO.	FUNCTION
1	HIGH VOLTAGE NO. 1
2	HIGH VOLTAGE NO. 2
3	HIGH VOLTAGE NO. 3
4	A B Volts
5	GROUND NO. 1
6	GROUND NO. 2
7	A 75V (B 75V MAX 500 Mhz)
8	50 Volts
9	50 Volts

QTY	ITEM	NOMENCLATURE OR	IDENTIFYING NO.	PART OR	MATERIAL OR	UNIT
REQD	NO.	DESCRIPTION	ON	NO.	NOTE	WT
<div style="display: flex; justify-content: space-between;"> <div>DO NOT SCALE PRINT</div> <div>STATE UNIVERSITY OF IOWA DEPT OF PHYSICS & ASTRONOMY</div> </div>						
<div style="display: flex; justify-content: space-between;"> <div> <p>ALL DIMENSIONS SPECIFIED</p> <p>WITH TOLERANCES ON</p> <p>INCHES</p> <p>FRACTIONS</p> <p>XX ± .005</p> <p>XX ± .01</p> <p>XX ± .02</p> <p>XX ± .05</p> </div> <div> <p>REQUIREMENTS</p> <p>REQUIREMENTS</p> <p>REQUIREMENTS</p> <p>REQUIREMENTS</p> <p>REQUIREMENTS</p> </div> </div>						
<div style="display: flex; justify-content: space-between;"> <div> <p>MATERIAL</p> <p>N/A</p> </div> <div> <p>POWER SUPPLY -</p> <p>UNIT 25</p> </div> </div>						
<div style="display: flex; justify-content: space-between;"> <div> <p>FINISH REQD</p> <p>N/A</p> </div> <div> <p>02542 C 33-1002</p> </div> </div>						
<div style="display: flex; justify-content: space-between;"> <div> <p>UNCLASSIFIED</p> </div> <div> <p>1</p> </div> </div>						

2. TERMINALS OUTLET INLET TO BE IN LINE SPECIFIED ENVELOPE
 1. 4 HOLES TO BE USED IN CLEARANCE FOR MOUNTING SEEING
 NOTES: SURFACE OR WITHIN 1000 Mhz AND COMPRESSION LESS MIN.



APPLICATION			REVISIONS			
USED ON	NEXT ASS'Y.	FINAL ASS'Y.	ENG. CH. NO.	SYM	DATE	APPROVED
15		C 2825	320	A	29 AUG 13	<i>[Signature]</i>
			323	B	6 SEP 63	<i>[Signature]</i>

QTY		TITLE		DESCRIPTION		ITEM
UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES		DR	SCHO	DATE		 Matrix RESEARCH AND DEVELOPMENT CORP. <small>HANNA, NEW HAMPSHIRE</small>
TOLERANCES		CHK.		JUN 63		
DEC = .005		ENG APPD		8-7-63		
FRAC = 1/64		MFG. APPD		8-7-63		
ANGLES ± 1/4°						
DEBURR				TITLE		SCHEMATIC MARINER "C" POWER SUPPLY
MAT'L:				SCALE		
				DWG NO. B -2780 SEP B		
				CAGE		OF

APPLICATION

REQ. NO. 22825
 DATE 11-15-68
 DESIGNED BY J. J. JONES
 CHECKED BY J. J. JONES
 APPROVED BY J. J. JONES

REVISIONS

REV.	DATE	BY	DESCRIPTION
1	11-15-68	J. J. JONES	INITIAL DESIGN
2	11-15-68	J. J. JONES	REVISED FOR CONFORMANCE
3	11-15-68	J. J. JONES	REVISED FOR CONFORMANCE
4	11-15-68	J. J. JONES	REVISED FOR CONFORMANCE
5	11-15-68	J. J. JONES	REVISED FOR CONFORMANCE
6	11-15-68	J. J. JONES	REVISED FOR CONFORMANCE
7	11-15-68	J. J. JONES	REVISED FOR CONFORMANCE
8	11-15-68	J. J. JONES	REVISED FOR CONFORMANCE
9	11-15-68	J. J. JONES	REVISED FOR CONFORMANCE
10	11-15-68	J. J. JONES	REVISED FOR CONFORMANCE

NOTE

1. FROXY BOND ITEM 12, 8 & 9 TOGETHER.

2. INSERT THRU HOLE NO. 2, 9 IN TERMINAL BOARD.

3. SOLDER PLATE 113 WITH 300 CAT. FOR CONFORMANCE TESTING.

4. C22, C23, C24 ARE 003 uF INSTALLED IN MC-4 ONLY.

TERMINAL BOARD CHART

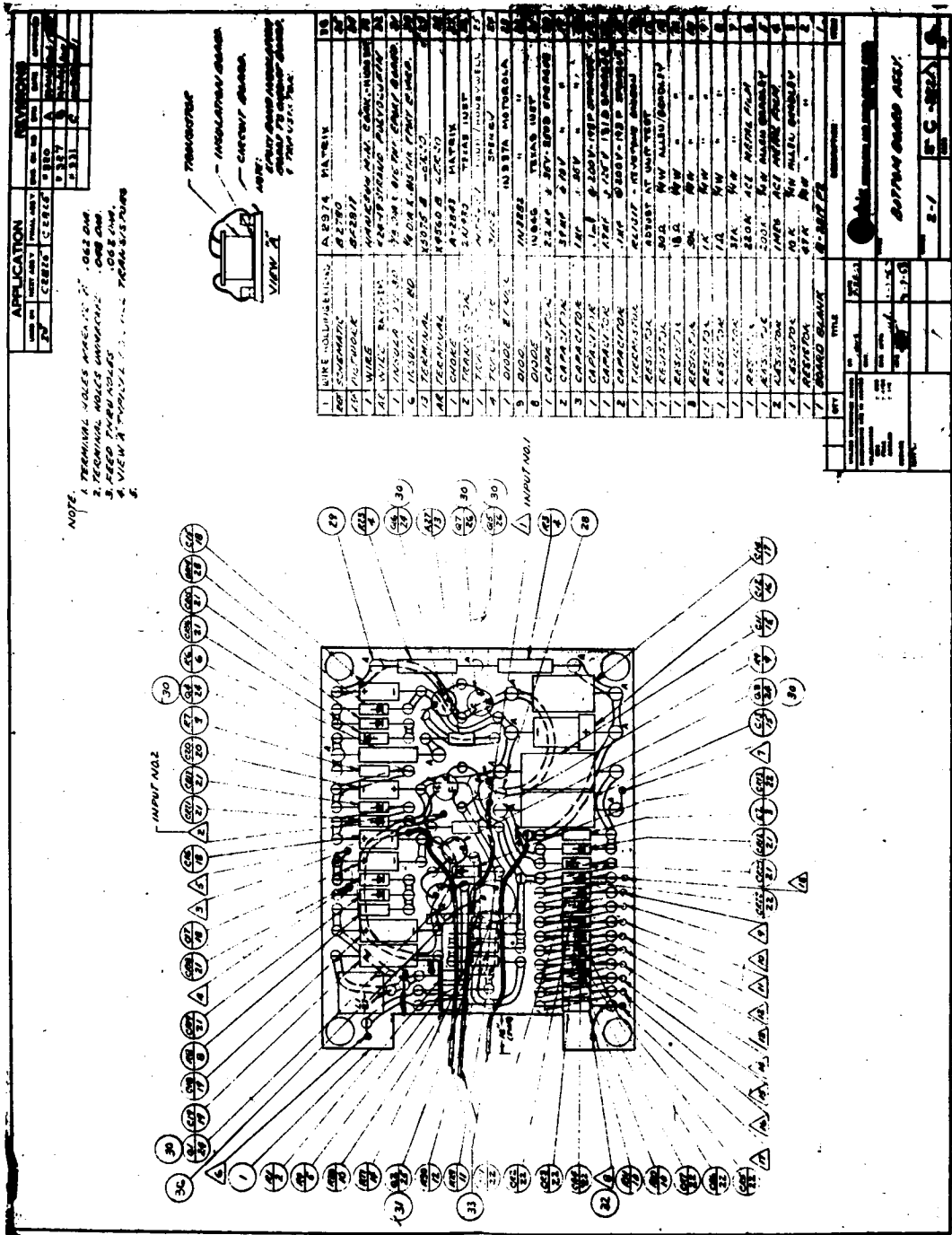
NO.	FUNCTION
1	HIGH VOLTAGE NO. 1
2	HIGH VOLTAGE NO. 2
3	HIGH VOLTAGE NO. 3
4	18V
5	GROUND NO. 1
6	GROUND NO. 2
7	125V
8	INPUT NO. 1
9	INPUT NO. 2

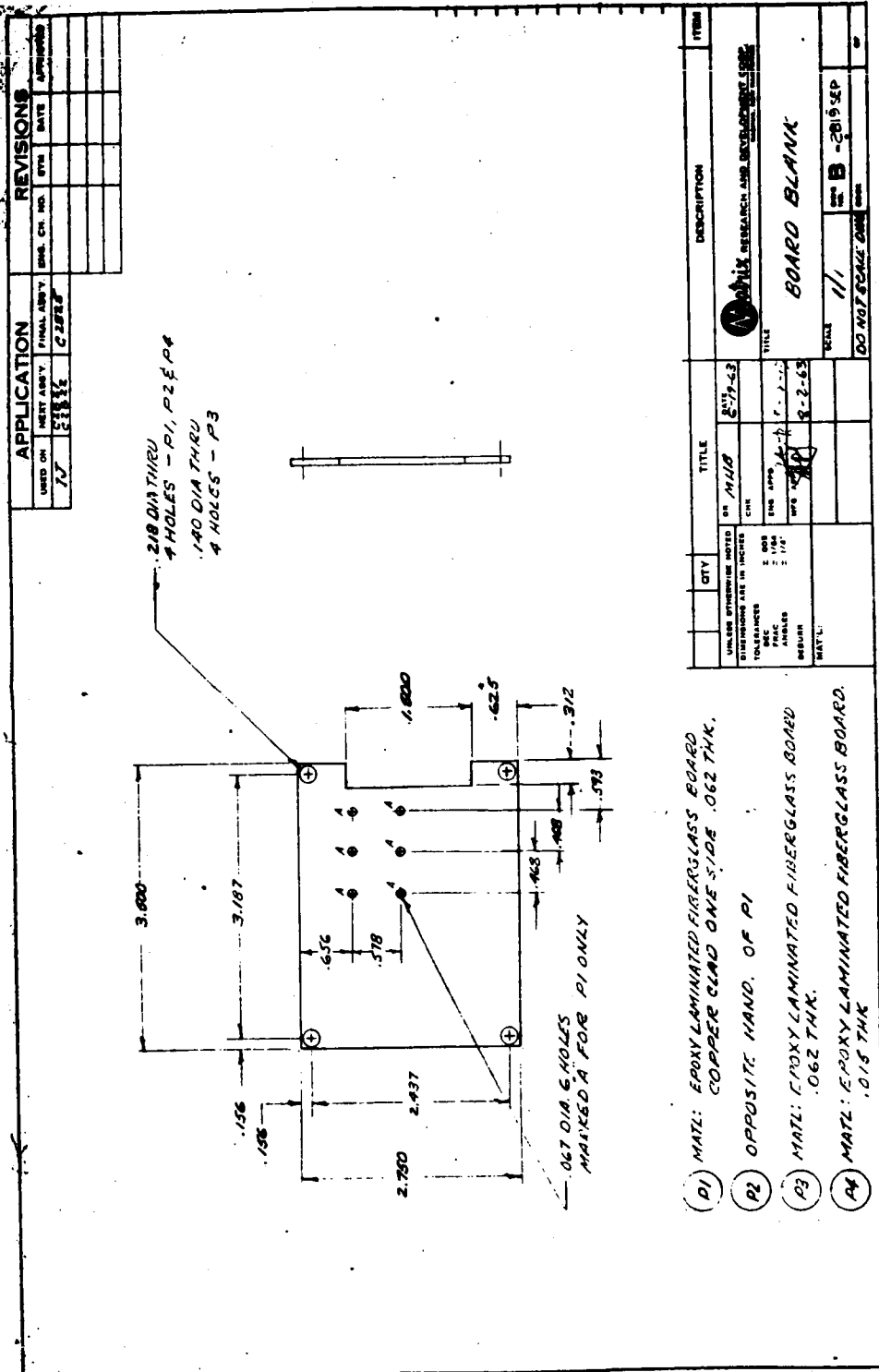
DESCRIPTION

ITEM	DESCRIPTION
1	MC-4
2	MC-4
3	MC-4
4	MC-4
5	MC-4
6	MC-4
7	MC-4
8	MC-4
9	MC-4
10	MC-4

REVISIONS

REV.	DATE	BY	DESCRIPTION
1	11-15-68	J. J. JONES	INITIAL DESIGN
2	11-15-68	J. J. JONES	REVISED FOR CONFORMANCE
3	11-15-68	J. J. JONES	REVISED FOR CONFORMANCE
4	11-15-68	J. J. JONES	REVISED FOR CONFORMANCE
5	11-15-68	J. J. JONES	REVISED FOR CONFORMANCE
6	11-15-68	J. J. JONES	REVISED FOR CONFORMANCE
7	11-15-68	J. J. JONES	REVISED FOR CONFORMANCE
8	11-15-68	J. J. JONES	REVISED FOR CONFORMANCE
9	11-15-68	J. J. JONES	REVISED FOR CONFORMANCE
10	11-15-68	J. J. JONES	REVISED FOR CONFORMANCE






APPLICATION				REVISIONS			
USED ON	NEXT ASSY.	FINAL ASSY.	ENG. CH. NO.	SYM	DATE	APPROVED	
LJ	C2825	C2825					


MATERIAL: 6061 T6 ALUM

UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES TOLERANCES DEC .005 FRAC 1/64 ANGLES 1/4 DEBURR	DR.	DATE	Matrix RESEARCH AND DEVELOPMENT CORP. <small>NASHUA, NEW HAMPSHIRE</small>
	CHR.		
	ENG APPD.	8-2-63	
	MFG APPD.	9/17/63	
			TITLE INSERT
			SCALE 2-1
			A-2801 SEP
			CODE

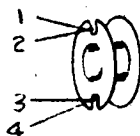
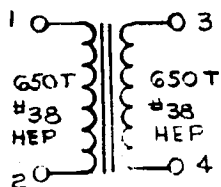
APPLICATION			REVISIONS			
VERSION	NEXT ASS'Y.	FINAL ASS'Y.	ENG. CH. NO.	SYM	DATE	APPROVED
1J	02821	02825				



1. BOBBIN: E-463
2. LAMINATIONS: EE 30-31 (EE 094-A026-A6)
3. USE SELF LEADS.
4. #56 MYLAR TAPE TO HOLD LEADS IN POSITION & TO HOLD CORE TOGETHER
5. RESISTANCE 1-2 0.9Ω.


UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES TOLERANCES DEC. ± .008 FRAC. ± 1/64 ANGLES ± 1/4° DESURR	DR	MHB	DATE	2-2-63	 Matrix RESEARCH AND DEVELOPMENT CORP. <small>NASHUA, NEW HAMPSHIRE</small>	
	CHK.					
	ENG. APPD.	JMR	8-7-63	TITLE		CHOKE
	MFG. APPD.	SM	7-7-63	SCALE		NONE
				DWG. NO.		A-2843
				CODE	OF	

APPLICATION			REVISIONS			
USED ON	NEXT ASS'Y.	FINAL ASS'Y.	ENG. CH. NO.	SYM	DATE	APPROVED
15			320	A	7-2-63	W.H. / [Signature]



NOTES:

1. BOBBIN #2-5665-A OR 1-5666-B (SEE ABOVE)
2. CORE: CF-213 (TI) WHITE-BLUE DOTS
3. WIND PRIMARY AND FOLLOW WITH SECONDARY
USE #38 HEP FOR BOTH WINDINGS (650T)
USE #31 HEP WITH TEFLON SLEEVING FOR LEADS
4. WIND 650 TURNS OF #38 HEP AS IN NOTE 3
BUT USE TWO LAYERS OF NO. 20 PLASTIC TAPE BETWEEN WINDINGS - VACUUM IMPREGNATE - PRIMARY LEADS TO COME OUT ONE HOLE - SAME FOR SECONDARY - USE HOLES ON ONE SIDE ONLY

UNLESS OTHERWISE NOTED	DR. SCHO	DATE 30 AUG 63	 Matrix RESEARCH AND DEVELOPMENT CORP. <small>100 N. MAIN ST. NASHUA, NEW HAMPSHIRE</small>
DIMENSIONS ARE IN INCHES	CHK.		
TOLERANCES DEC. = .005 FAC. 1/64 ANGLES 1/4"	ENG. APPD. [Signature]	1-2-63	TITLE
DESIGN	MFG. APPD. [Signature]	10-8-63	TOROID
MAT'L.			SCALE NONE
			FILE # 2824

APPLICATION				REVISIONS			
USED ON	NEXT ASS'Y.	FINAL ASS'Y.	ENG. CH. NO.	SYM	DATE	APPROVED	
13	C2822	C2825	320	A	9-2-63	<i>[Signature]</i>	

PRI (2) (3) SEC #1
 1 0 3
 1080T #44 HEP
 04
 1080T
 2 0 5
 06
 255T
 07
 255T #36 HEP
 08 BIFILAR
SEC #2
 (1)

NOTES

1. CORE: 51033-1F / MAGNETICS INC
2. USE #56 MYLAR TAPE (ONE LAYER) ON CORE
3. SECONDARY #2 > 1/2 OF CORE
PRIMARY < 1/2 OF CORE
4. WINDING SEQUENCE (1) (2) (3)
5. WIND WITH ONE LAYER #20 PLASTIC TAPE AND WIND (3) AS CAREFULLY AS POSSIBLE LEAVING ABOUT 2 1/8" WINDOW
6. CHANGE LEADS TO RET. 24(19) 3 1/2" LONG
7. TAPE COMPLETED TRANSFORMER WITH #56 MYLAR
8. VACUUM IMPREGNATE AFTER WINDING (2) AND AFTER (3)
- 9 RESISTANCE:

1-2	120Ω
5-4	340Ω
5-3	1100Ω
7-6	10.0Ω
7-8	10.0Ω

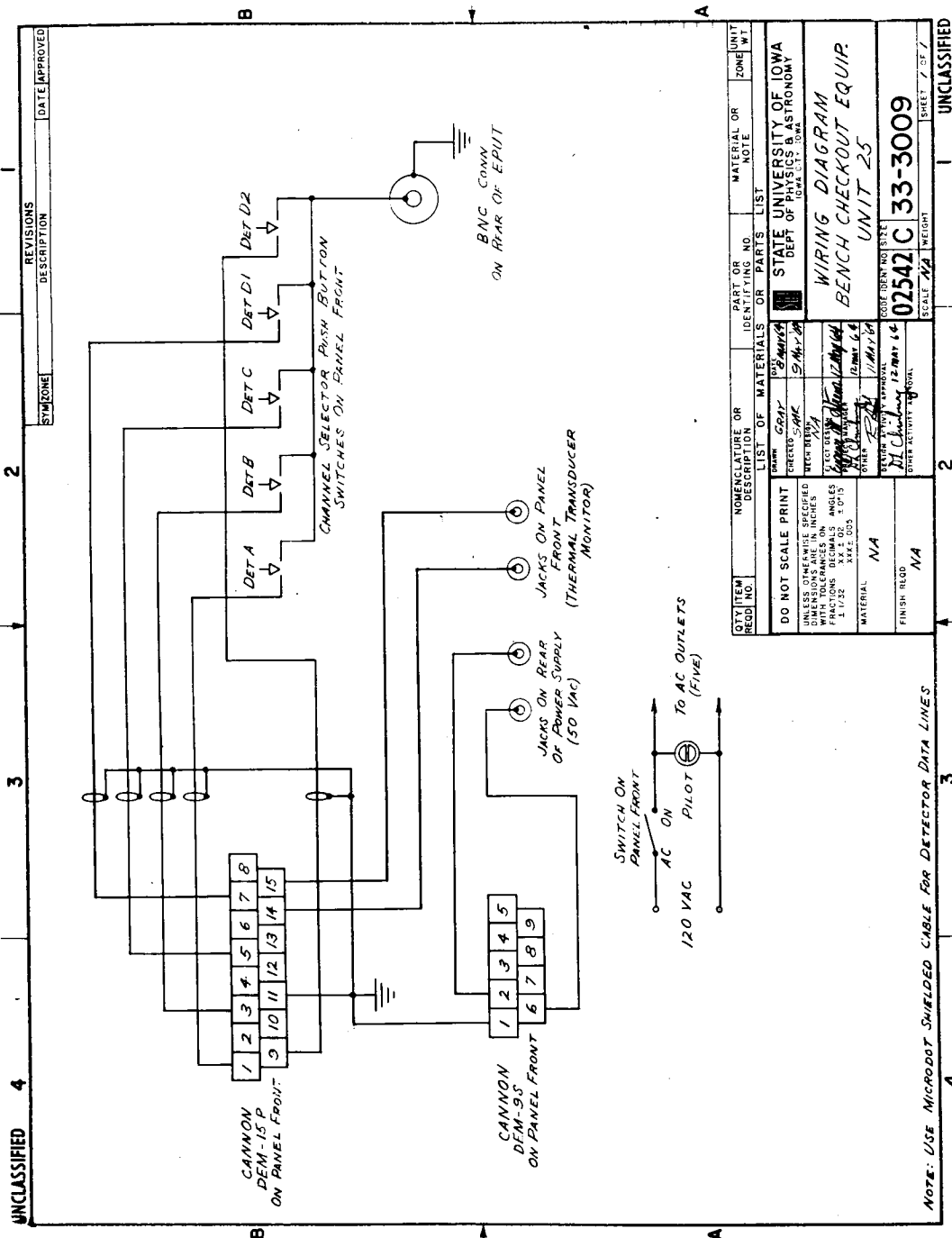
UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES TOLERANCES DEC. = .008 FRAC. = 1/64 ANGLES = 1/4" DESURR MAT'L:	DR. SCHO	DATE 3 SEP 63	Matrix RESEARCH AND DEVELOPMENT CORP. <small>NASHUA, NEW HAMPSHIRE</small> TITLE TOROID SCALE NONE DWG. NO. A-2845 CORR.
	CHK.		
	ENG. APPD. <i>[Signature]</i>	9-2-	
	WPS. APPD. <i>[Signature]</i>	10-8-63	

UNCLASSIFIED

50

SYN		REVISIONS		DATE APPROVED	
DESCRIPTION		DESCRIPTION		DATE APPROVED	
<p>6-32 UNC-3A</p> <p>2.FAO 13Y UNLESS OTHERWISE SPECIFIED. FILED.</p> <p>NOTES: 1. REMOVE ALL BURRS AND SHARP EDGES.</p>					
LIST OF MATERIALS OR PARTS LIST					
QTY	ITEM	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	MATERIAL OR NOTE	UNIT WT
DO NOT SCALE PRINT					
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES WITH TOLERANCES ON: FRACTIONS DECIMALS ANGLES ± 1/32 .XX ± .02 ± 0°15' .XXX ± .003					
MATERIAL STAINLESS STEEL					
FINISH REQD A-286					
SEE NOTES 2#2					
DRAWN: H. G. D. 17 DATE: 2 SEPT 63					
CHECKED: [Signature] DATE: 30 SEP 63					
MECH DESIGN: [Signature] DATE: 27 SEP 63					
ELECT DESIGN: [Signature] DATE: 30 SEP 63					
PROJECT MANAGER: [Signature] DATE: 30 SEP 63					
OTHER: [Signature]					
DESIGN ACTIVITY APPROVAL: [Signature] DATE: 30 SEP 63					
OTHER ACTIVITY APPROVAL: [Signature]					
CODE IDENT NO. SIZE 02542 A 33-0007					
SCALE 2/1 WEIGHT SHEET / OF /					

UNCLASSIFIED

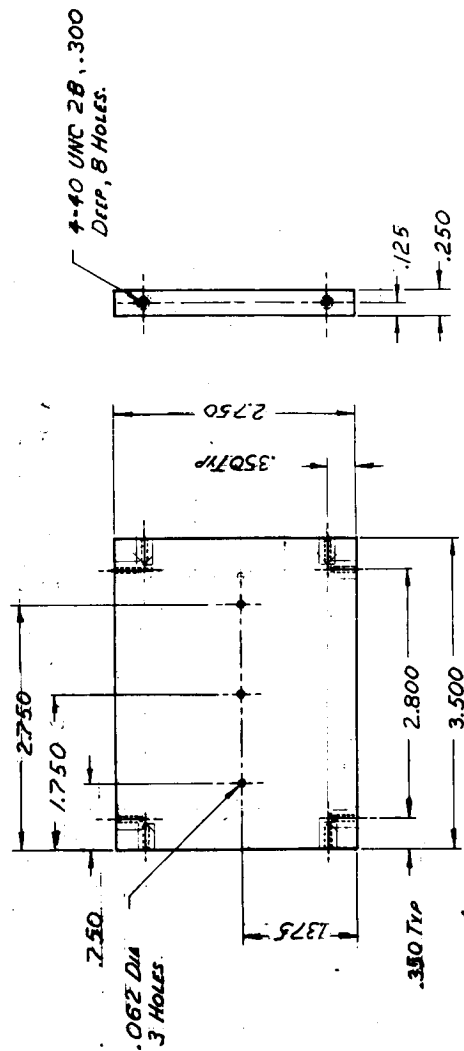


UNCLASSIFIED

SYMBOL		REVISIONS		DATE APPROVED																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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<table border="1"> <thead> <tr> <th>QTY</th> <th>ITEM</th> <th>DESCRIPTION</th> <th>UNIT</th> </tr> </thead> <tbody> <tr> <td>16</td> <td>6</td> <td>SCREW, ALLEN HEAD</td> <td>Allen Mfg. Co.</td> </tr> <tr> <td>1</td> <td>8</td> <td>BLOCK, PROTECTIVE</td> <td>NA</td> </tr> <tr> <td>1</td> <td>3</td> <td>COVER, SIDE D</td> <td>NA</td> </tr> <tr> <td>1</td> <td>3</td> <td>COVER, SIDE C</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE R AND F</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE A AND E</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE B AND G</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE H AND I</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE J AND K</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE L AND M</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE N AND O</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE P AND Q</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE R AND S</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE T AND U</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE V AND W</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE X AND Y</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE Z AND AA</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE AB AND AC</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE AD AND AE</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE AF AND AG</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE AH AND AI</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE AJ AND AK</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE AL AND AM</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE AN AND AO</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE AP AND AQ</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE AR AND AS</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE AT AND AU</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE AV AND AW</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE AX AND AY</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE AZ AND BA</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE BB AND BC</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE BD AND BE</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE BF AND BG</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE BH AND BI</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE BJ AND BK</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE BL AND BM</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE BN AND BO</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE BP AND BQ</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE BR AND BS</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE BT and BU</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE BV AND BW</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE BX AND BY</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE BZ and CA</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE CB and CC</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE CD and CE</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE CF and CG</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE CH and CI</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE CJ and CK</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE CL and CM</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE CN and CO</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE CP and CQ</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE CR and CS</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE CT and CU</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE CV and CW</td> <td>NA</td> 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<td>2</td> <td>2</td> <td>COVER, SIDE DX and DY</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE DZ and EA</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE EB and EC</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE ED and EE</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE EF and EG</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE EH and EI</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE EJ and EK</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE EL and EM</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE EN and EO</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE EP and EQ</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE ER and ES</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE ET and EU</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE EV and EW</td> <td>NA</td> </tr> <tr> <td>2</td> 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<td>2</td> <td>COVER, SIDE LZ and MA</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE MB and MC</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE MD and ME</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE MF and MG</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE MH and MI</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE MJ and MK</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE ML and MM</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE MN and MO</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE MP and MQ</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE MR and MS</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE MT and MU</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE MV and MW</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE MX and MY</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2</td> <td>COVER, SIDE MZ and NA</td> <td>NA</td> </tr> </tbody> </table>						QTY	ITEM	DESCRIPTION	UNIT	16	6	SCREW, ALLEN HEAD	Allen Mfg. Co.	1	8	BLOCK, PROTECTIVE	NA	1	3	COVER, SIDE D	NA	1	3	COVER, SIDE C	NA	2	2	COVER, SIDE R AND F	NA	2	2	COVER, SIDE A AND E	NA	2	2	COVER, SIDE B AND G	NA	2	2	COVER, SIDE H AND I	NA	2	2	COVER, SIDE J AND K	NA	2	2	COVER, SIDE L AND M	NA	2	2	COVER, SIDE N AND O	NA	2	2	COVER, SIDE P AND Q	NA	2	2	COVER, SIDE R AND S	NA	2	2	COVER, SIDE T AND U	NA	2	2	COVER, SIDE V AND W	NA	2	2	COVER, SIDE X AND Y	NA	2	2	COVER, SIDE Z AND AA	NA	2	2	COVER, SIDE AB AND AC	NA	2	2	COVER, SIDE AD AND AE	NA	2	2	COVER, SIDE AF AND AG	NA	2	2	COVER, SIDE AH AND AI	NA	2	2	COVER, SIDE AJ AND AK	NA	2	2	COVER, SIDE AL AND AM	NA	2	2	COVER, SIDE AN AND AO	NA	2	2	COVER, SIDE AP AND AQ	NA	2	2	COVER, SIDE AR AND AS	NA	2	2	COVER, SIDE AT AND AU	NA	2	2	COVER, SIDE AV AND AW	NA	2	2	COVER, SIDE AX AND AY	NA	2	2	COVER, SIDE AZ AND BA	NA	2	2	COVER, SIDE BB AND BC	NA	2	2	COVER, SIDE BD AND BE	NA	2	2	COVER, SIDE BF AND BG	NA	2	2	COVER, SIDE BH AND BI	NA	2	2	COVER, SIDE BJ AND BK	NA	2	2	COVER, SIDE BL AND BM	NA	2	2	COVER, SIDE BN AND BO	NA	2	2	COVER, SIDE BP AND BQ	NA	2	2	COVER, SIDE BR AND BS	NA	2	2	COVER, SIDE BT and BU	NA	2	2	COVER, SIDE BV AND BW	NA	2	2	COVER, SIDE BX AND BY	NA	2	2	COVER, SIDE BZ and CA	NA	2	2	COVER, SIDE CB and CC	NA	2	2	COVER, SIDE CD and CE	NA	2	2	COVER, SIDE CF and CG	NA	2	2	COVER, SIDE CH and CI	NA	2	2	COVER, SIDE CJ and CK	NA	2	2	COVER, SIDE CL and CM	NA	2	2	COVER, SIDE CN and CO	NA	2	2	COVER, SIDE CP and CQ	NA	2	2	COVER, SIDE CR and CS	NA	2	2	COVER, SIDE CT and CU	NA	2	2	COVER, SIDE CV and CW	NA	2	2	COVER, SIDE CX and CY	NA	2	2	COVER, SIDE CZ and DA	NA	2	2	COVER, SIDE DB and DC	NA	2	2	COVER, SIDE DD and DE	NA	2	2	COVER, SIDE DF and DG	NA	2	2	COVER, SIDE DH and DI	NA	2	2	COVER, SIDE DJ and DK	NA	2	2	COVER, SIDE DL and DM	NA	2	2	COVER, SIDE DN and DO	NA	2	2	COVER, SIDE DP and DQ	NA	2	2	COVER, SIDE DR and DS	NA	2	2	COVER, SIDE DT and DU	NA	2	2	COVER, SIDE DV and DW	NA	2	2	COVER, SIDE DX and DY	NA	2	2	COVER, SIDE DZ and EA	NA	2	2	COVER, SIDE EB and EC	NA	2	2	COVER, SIDE ED and EE	NA	2	2	COVER, SIDE EF and EG	NA	2	2	COVER, SIDE EH and EI	NA	2	2	COVER, SIDE EJ and EK	NA	2	2	COVER, SIDE EL and EM	NA	2	2	COVER, SIDE EN and EO	NA	2	2	COVER, SIDE EP and EQ	NA	2	2	COVER, SIDE ER and ES	NA	2	2	COVER, SIDE ET and EU	NA	2	2	COVER, SIDE EV and EW	NA	2	2	COVER, SIDE EX and EY	NA	2	2	COVER, SIDE EZ and FA	NA	2	2	COVER, SIDE FB and FC	NA	2	2	COVER, SIDE FD and FE	NA	2	2	COVER, SIDE FF and FG	NA	2	2	COVER, SIDE FH and FI	NA	2	2	COVER, SIDE FJ and FK	NA	2	2	COVER, SIDE FL and FM	NA	2	2	COVER, SIDE FN and FO	NA	2	2	COVER, SIDE FP and FQ	NA	2	2	COVER, SIDE FR and FS	NA	2	2	COVER, SIDE FT and FU	NA	2	2	COVER, SIDE FV and FW	NA	2	2	COVER, SIDE FX and FY	NA	2	2	COVER, SIDE FZ and GA	NA	2	2	COVER, SIDE GB and GC	NA	2	2	COVER, SIDE GD and GE	NA	2	2	COVER, SIDE GF and GG	NA	2	2	COVER, SIDE GH and GI	NA	2	2	COVER, SIDE GJ and GK	NA	2	2	COVER, SIDE GL and GM	NA	2	2	COVER, SIDE GN and GO	NA	2	2	COVER, SIDE GP and GQ	NA	2	2	COVER, SIDE GR and GS	NA	2	2	COVER, SIDE GT and GU	NA	2	2	COVER, SIDE GV and GW	NA	2	2	COVER, SIDE GX and GY	NA	2	2	COVER, SIDE GZ and HA	NA	2	2	COVER, SIDE HB and HC	NA	2	2	COVER, SIDE HD and HE	NA	2	2	COVER, SIDE HF and HG	NA	2	2	COVER, SIDE HH and HI	NA	2	2	COVER, SIDE HJ and HK	NA	2	2	COVER, SIDE HL and HM	NA	2	2	COVER, SIDE HN and HO	NA	2	2	COVER, SIDE HP and HQ	NA	2	2	COVER, SIDE HR and HS	NA	2	2	COVER, SIDE HT and HU	NA	2	2	COVER, SIDE HV and HW	NA	2	2	COVER, SIDE HX and HY	NA	2	2	COVER, SIDE HZ and IA	NA	2	2	COVER, SIDE IB and IC	NA	2	2	COVER, SIDE ID and IE	NA	2	2	COVER, SIDE IF and IG	NA	2	2	COVER, SIDE IH and II	NA	2	2	COVER, SIDE IJ and IK	NA	2	2	COVER, SIDE IL and IM	NA	2	2	COVER, SIDE IN and IO	NA	2	2	COVER, SIDE IP and IQ	NA	2	2	COVER, SIDE IR and IS	NA	2	2	COVER, SIDE IT and IU	NA	2	2	COVER, SIDE IV and IW	NA	2	2	COVER, SIDE IX and IY	NA	2	2	COVER, SIDE IZ and JA	NA	2	2	COVER, SIDE JB and JC	NA	2	2	COVER, SIDE JD and JE	NA	2	2	COVER, SIDE JF and JG	NA	2	2	COVER, SIDE JH and JI	NA	2	2	COVER, SIDE JJ and 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<p>DO NOT SCALE PRINT</p> <p>UNLESS OTHERWISE SPECIFIED</p> <p>ALL DIMENSIONS ARE IN INCHES</p> <p>FRACTIONS DECIMALS ANGLES</p> <p>2 1/2 2 0/16</p> <p>XXX 2 008</p> <p>MATERIAL NA</p> <p>FINISH REQ</p> <p>See Note 1</p> <p>SCALE 1" = 2 1/2" WT</p> <p>UNIT</p> <p>33-1004</p> <p>02542 C</p> <p>ASSY, ENCAPSULATION</p> <p>MOLD- PWR SUP, UNIT 25</p> <p>STATE OF IOWA</p> <p>UNIVERSITY OF IOWA</p> <p>DEPT OF PHYSICS & ASTRONOMY</p> <p>1000 2000 3000 4000 5000 6000 7000 8000 9000 10000</p> <p>11000 12000 13000 14000 15000 16000 17000 18000 19000 20000</p> <p>21000 22000 23000 24000 25000 26000 27000 28000 29000 30000</p> <p>31000 32000 33000 34000 35000 36000 37000 38000 39000 40000</p> <p>41000 42000 43000 44000 45000 46000 47000 48000 49000 50000</p> <p>51000 52000 53000 54000 55000 56000 57000 58000 59000 60000</p> <p>61000 62000 63000 64000 65000 66000 67000 68000 69000 70000</p> <p>71000 72000 73000 74000 75000 76000 77000 78000 79000 80000</p> <p>81000 82000 83000 84000 85000 86000 87000 88000 89000 90000</p> <p>91000 92000 93000 94000 95000 96000 97000 98000 99000 100000</p>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	

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QTY ITEM REQD NO.	NOMENCLATURE OR DESCRIPTION	LIST OF MATERIALS	PART OR IDENTIFYING NO.	MATERIAL OR NOTE	UNIT WT.
DO NOT SCALE PRINT	UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES WITH TOLERANCES ON: FRACTIONS DECIMALS ANGLES .XX ± .02 ± 0° 15' ± 1/32 .XXX ± .006	DRAWN BY 68003-7 CHECKED BY <i>Paul Hoffman</i> DATE 20 SEP 63 ELEV BY <i>W. J. [illegible]</i> PROJECT NUMBER 2-5300-23 OTHER <i>254</i>	STATE UNIVERSITY OF IOWA DEPT OF PHYSICS & ASTRONOMY IOWA CITY, IOWA COVER, SIDE A- AND E - ENCAPSULATION, LAMCO, UNIT 25		
MATERIAL	AL	DESIGN ACTIVITY APPROVAL <i>By [illegible] 2-5300-23</i> OTHER ACTIVITY APPROVAL	COORDINATING OFFICE 02542 B	33-0009	
FINISH REQD	SEE NOTE 1		SCALE 1/1	WEIGHT	SHEET 1 OF 1
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QTY ITEM REQD NO.		NOMENCLATURE OR DESCRIPTION		PART OR IDENTIFYING NO.		MATERIAL OR NOTE		UNIT	
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DO NOT SCALE PRINT		DRAWN 6002-7		STATE UNIVERSITY OF IOWA		DEPT OF PHYSICS & ASTRONOMY		IOWA CITY, IOWA	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES WITH TOLERANCES ON FRACTIONS DECIMALS ANGLES		CHECKED 24 SEP 63		COVER, SIDE B AND F -		ENCAPSULATION MOLD, UNIT 25			
MATERIAL		AL		CODE IDENTIFYING NO.		U2542 B		33-0010	
FINISH REQD		SEE NOTE 1		DESIGN ACTIVITY APPROVAL		SCALE 1/1		WEIGHT	
				OTHER ACTIVITY APPROVAL				SHEET 1 OF 1	

2.800 REF
3.500 REF
1.750
.125
.350 TIP
250
.120 DIA, 4 HOLES

2. REMOVE ALL BURRS AND SHARP EDGES.
NOTES: 1. F.A.O. UNLESS OTHERWISE SPECIFIED.

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DESCRIPTION

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APPROVED

2500 DIA

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125 TIP

1200

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3250 REF

120 DIA, 4 HOLES

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES WITH TOLERANCES ON: FRACTIONS .XX ± .02 ANGLES ± 1° 32' DECIMALS .XXX ± .005

MATERIAL AL

FINISH REQD SEE NOTE 1

LIST OF MATERIALS OR PARTS

STATE UNIVERSITY OF IOWA DEPT OF PHYSICS & ASTRONOMY

COVER, SIDE C- ENCAPSULATION MOLD, UNIT 25

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120 DIA, 4 HOLES

250

2. REMOVE ALL BURRS AND SHARP EDGES.

NOTES: 1. FAO UNLESS OTHERWISE SPECIFIED.

SCALE

ROLL

WEIGHT

SHEET

OF

1

UNCLASSIFIED

2

1

2

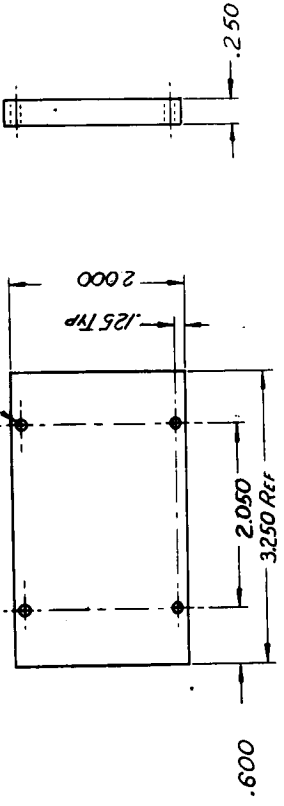
UNCLASSIFIED

UNCLASSIFIED

2

SYMBOL		REVISIONS		DATE		APPROV.	
		DESCRIPTION					

120 DIA. 4 HOLES



QTY ITEM	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	MATERIAL OR NOTE	UNIT
NO. 1	ENCAPSULATION MOLD, UNIT 25			WT
STATE UNIVERSITY OF IOWA DEPT. OF PHYSICS & ASTRONOMY IOVA CITY, IOWA				
COVER, SIDE D.				
ENCAPSULATION MOLD, UNIT 25				
02542 B 33-0012				
SCALE 1/2" = 1"				
WEIGHT 1.000 LB				
DO NOT SCALE PRINT				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES WITH TOLERANCES ON: FRACTIONS .XX ± .02 DECIMALS .XX ± .01 ANGLES ± 1/32				
MATERIAL 1AL				
FINISH REQ. SEE NOTE 1				
NOTES: 1. FAO BY UNLESS OTHERWISE SPECIFIED.				

2. REMOVE ALL BURRS AND SHARP EDGES.

NOTES: 1. FAO BY UNLESS OTHERWISE SPECIFIED.

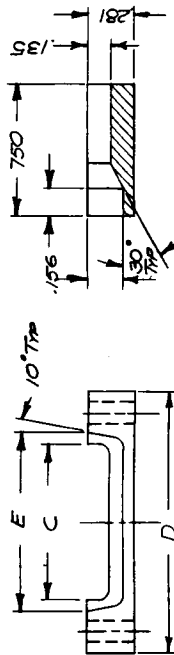
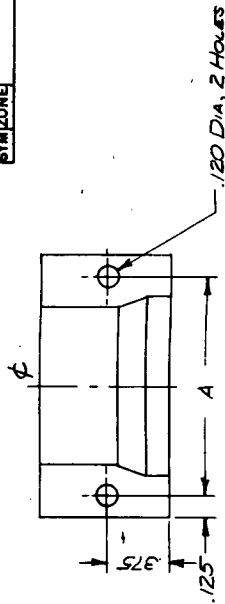
2

SYNOPSIS		REVISIONS		DATE APPROVED																
DESCRIPTION		DESCRIPTION		DATE APPROVED																
<table border="1" style="margin: auto;"> <tr> <th>Dim.</th> <th>9 PIN</th> <th>15 PIN</th> </tr> <tr> <td>A</td> <td>.937</td> <td>1.250</td> </tr> <tr> <td>B</td> <td>.750</td> <td>1.000</td> </tr> <tr> <td>C</td> <td>.575</td> <td>.897</td> </tr> <tr> <td>D</td> <td>1.187</td> <td>1.500</td> </tr> </table>		Dim.	9 PIN	15 PIN	A	.937	1.250	B	.750	1.000	C	.575	.897	D	1.187	1.500	<p>4-40 UNC-2B 2 HOLES</p>			
Dim.	9 PIN	15 PIN																		
A	.937	1.250																		
B	.750	1.000																		
C	.575	.897																		
D	1.187	1.500																		
<p>DO NOT SCALE PRINT</p> <p>UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES WITH TOLERANCES ON: FRACTIONS DECIMALS ANGLES XX ± .02 ± 0°15 ± 1/32 .001 ± .005</p>		<p>FINISH REQD SEE NOTE 2</p>																		
<p>MATERIAL TEFLON</p>		<p>DESIGN ACTIVITY APPROVAL BY <i>[Signature]</i> 18 Dec 64</p>																		
<p>QTY/ITEM REQD NO.</p>		<p>NOMENCLATURE OR DESCRIPTION</p>		<p>PART OR IDENTIFYING NO.</p>																
<p>LIST OF MATERIALS OR PARTS LIST</p>		<p>MATERIAL OR NOTE</p>		<p>UNIT ZONE WIT</p>																
<p>STATE UNIVERSITY OF IOWA DEPT OF PHYSICS & ASTRONOMY IOWA CITY, IOWA</p>		<p>MOLD - 9 & 15 PIN, TOP SIDE</p>																		
<p>CODE IDENT NO. SIZE</p>		<p>02542 B 33-0020</p>																		
<p>SCALE 2/1</p>		<p>WEIGHT</p>																		
<p>SHEET 2/ OF 1</p>		<p>UNCLASSIFIED</p>																		

2. REMOVE ALL BURRS AND SHARP EDGES.
NOTES: 1. ALL RADII .06 UNLESS OTHERWISE SPECIFIED.

2

REVISIONS		DATE	APPROVED
SYM	ZONE	DESCRIPTION	



1.900	.897	1.010	1.250	NA	2	MOLD - 15 PIN	33-0019-02	TEFLON	NA
1.187	.575	.686	.957	NA	1	MOLD - 9 PIN	33-0019-01	TEFLON	NA
Dim D	Dim C	Dim E	Dim A	QTY ITEM	DESCRIPTION	NOMENCLATURE OR	PART OR	MATERIAL OR	UNIT
				REQD NO.			IDENTIFYING NO.	NOTE	ZONE WT

LIST OF MATERIALS OR PARTS LIST

DO NOT SCALE PRINT

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
FRACTIONS DECIMALS ANGLES
2 1/32 .XXX ± .008

MATERIAL

FINISH REQD

SEE NOTE 2

2. REMOVE ALL BURRS AND SHARP EDGES.

NOTES: 1. ALL DIMS. TO UNLESS OTHERWISE SPECIFIED

STATE UNIVERSITY OF IOWA
DEPT OF PHYSICS & ASTRONOMY
187A CITY, IOWA

MOLD - 9 & 15 PIN,
BOTTOM SIDE

CODE IDENTIFYING

02542B

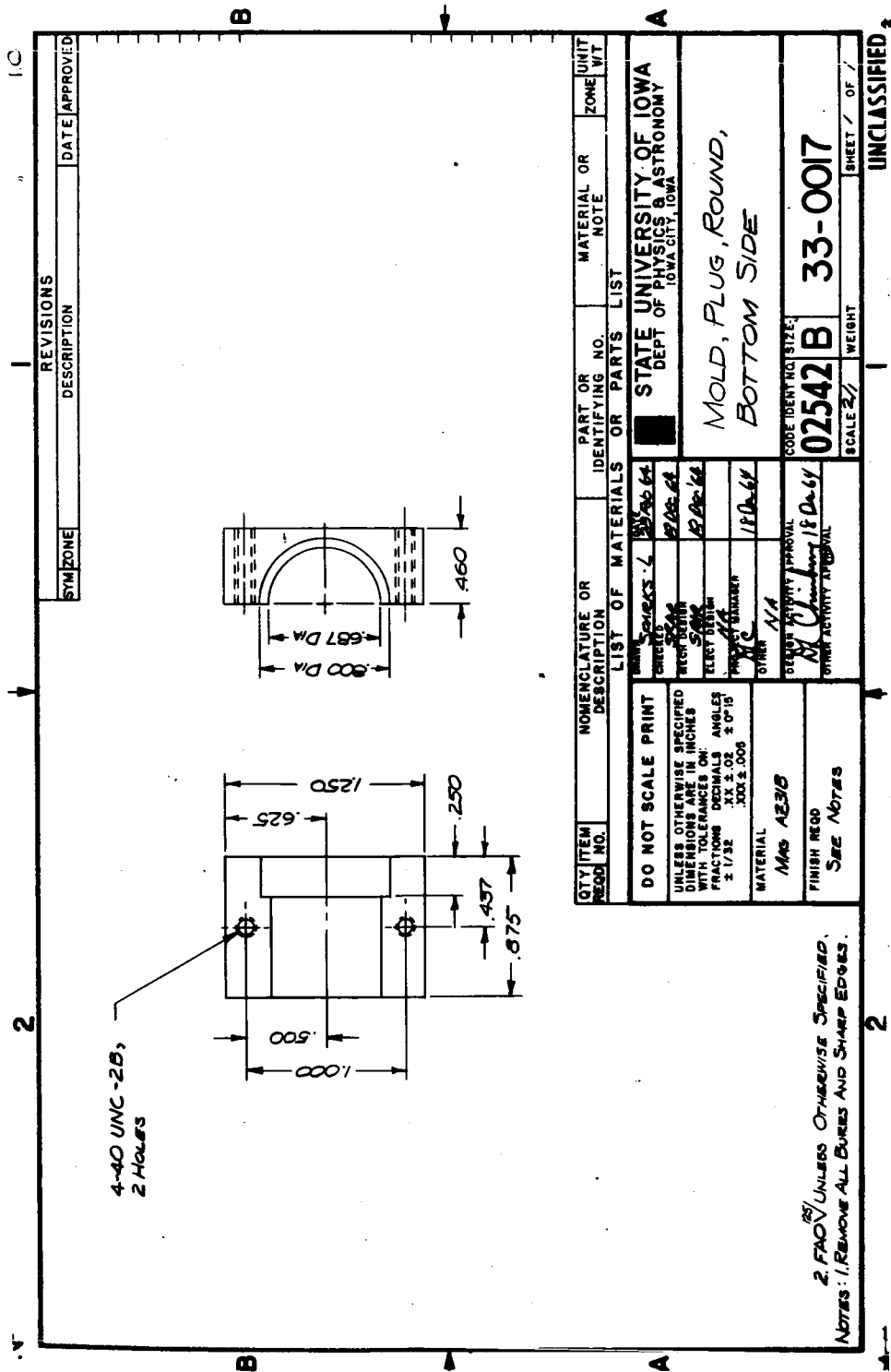
33-0019 01-

SCALE 3/4" = 1"

WEIGHT

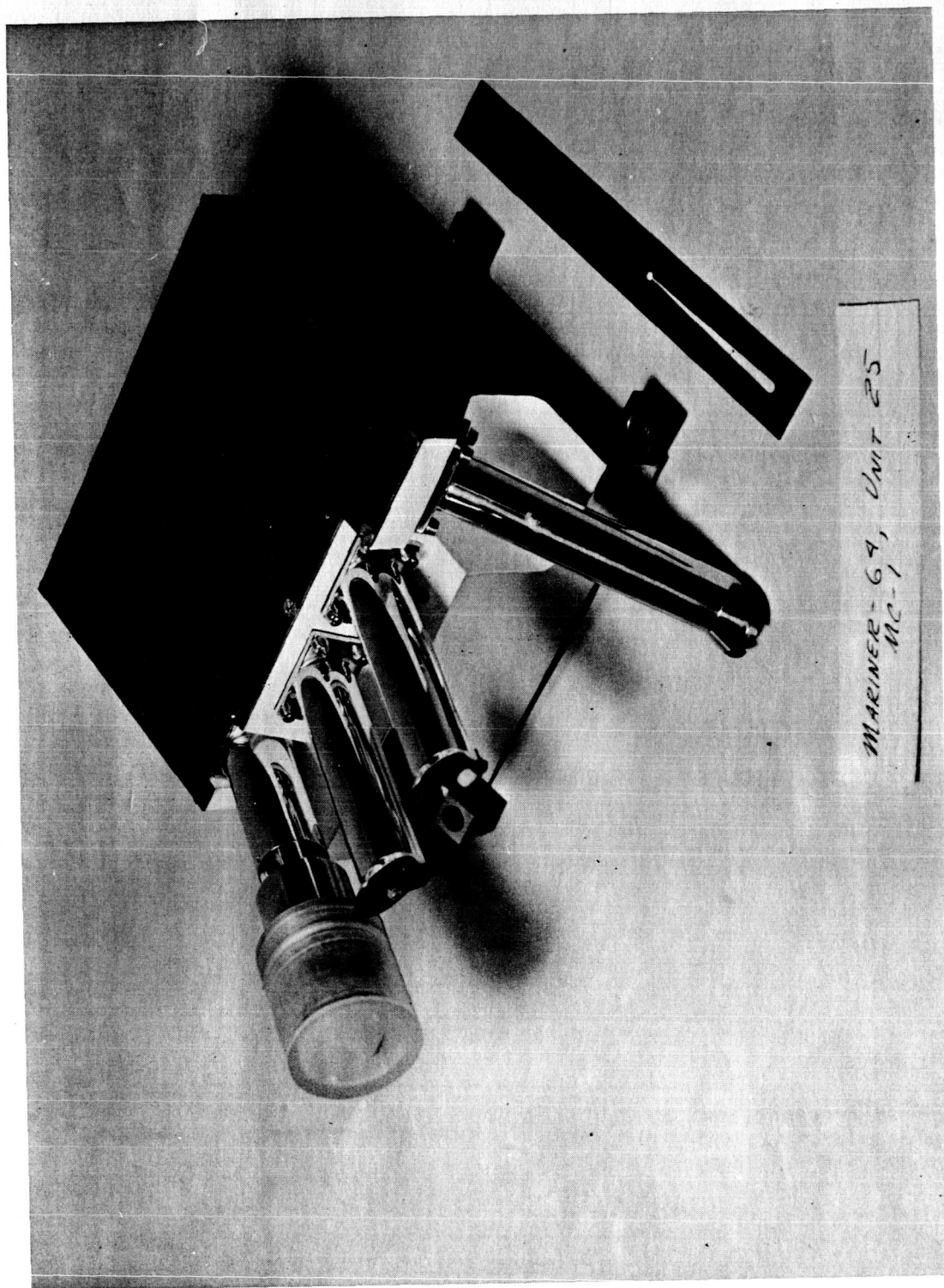
INCHES / sq. in.

UNCLASSIFIED



Appendix II

P H O T O G R A P H S

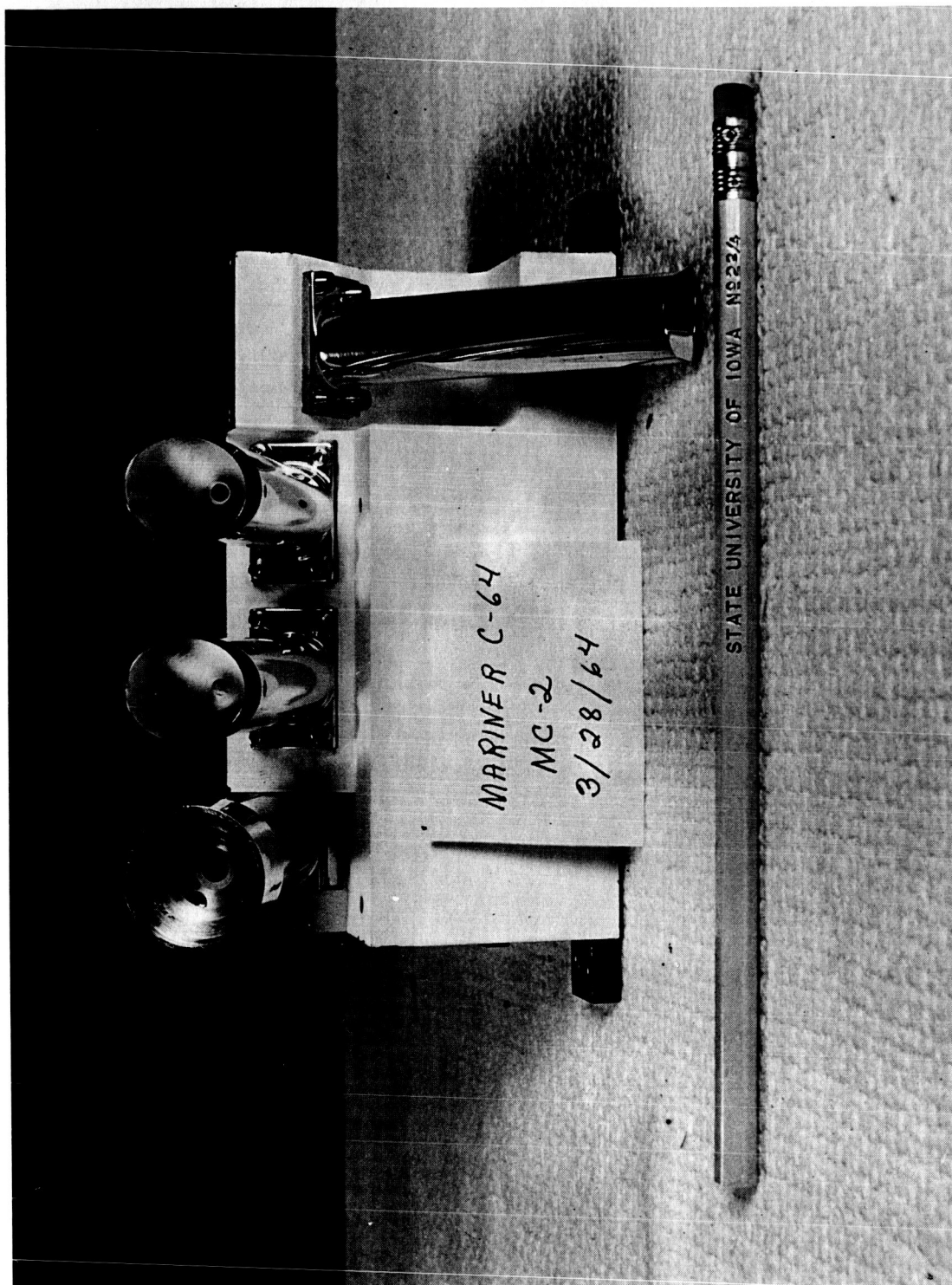


MARINER C-64

MC-2

3/28/64

STATE UNIVERSITY OF IOWA N2224

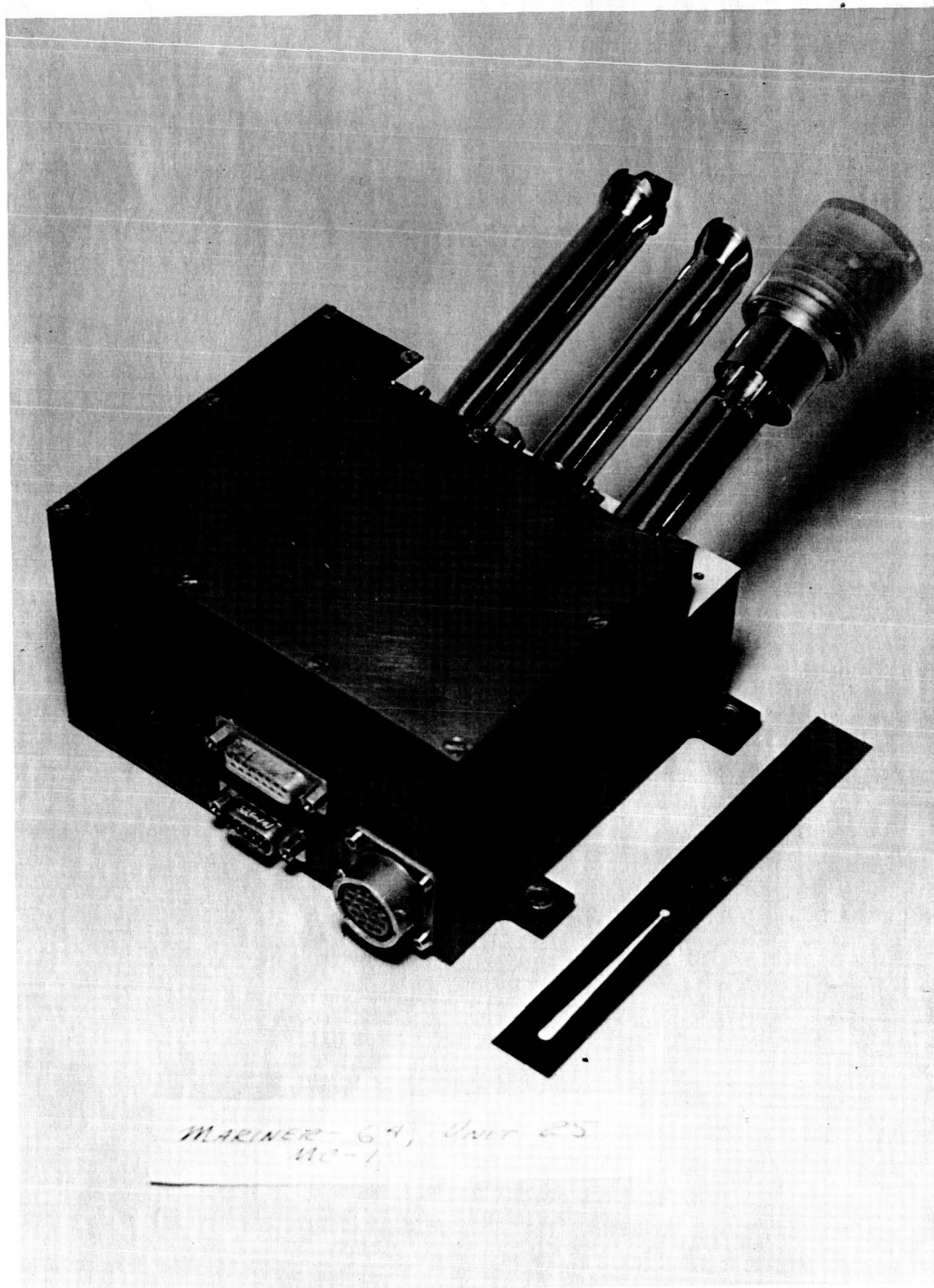


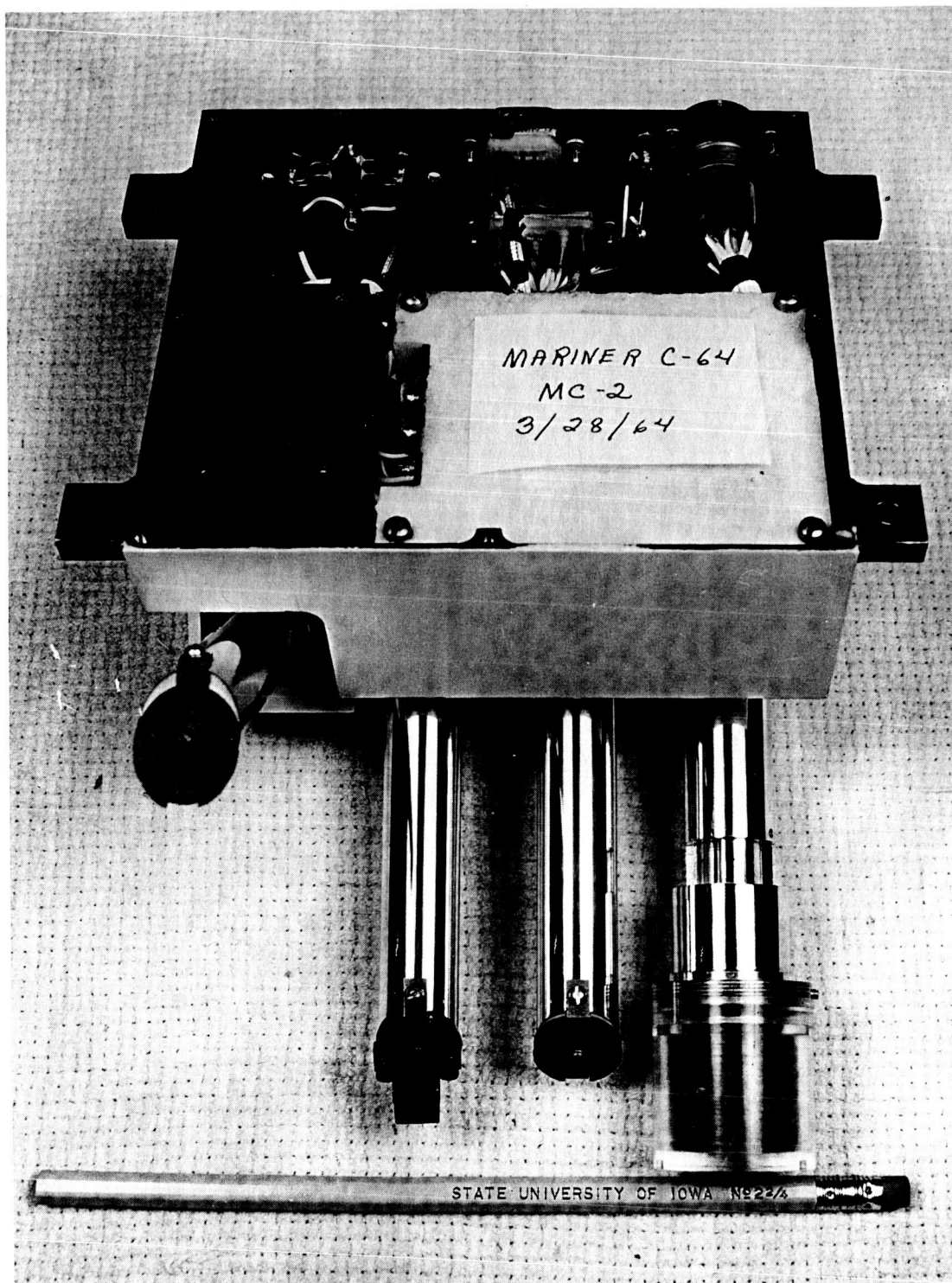
MARINER C-64

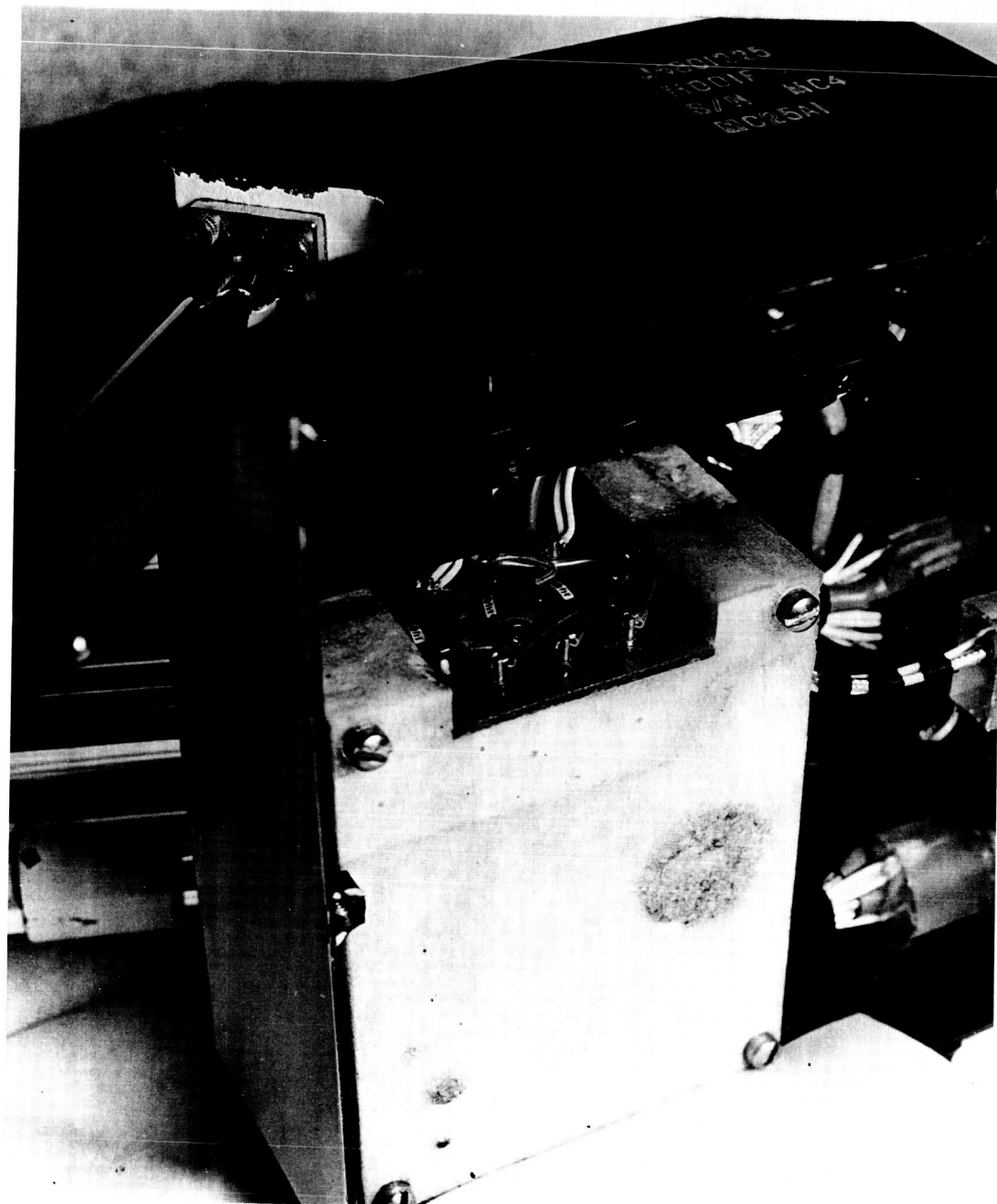
MC-2

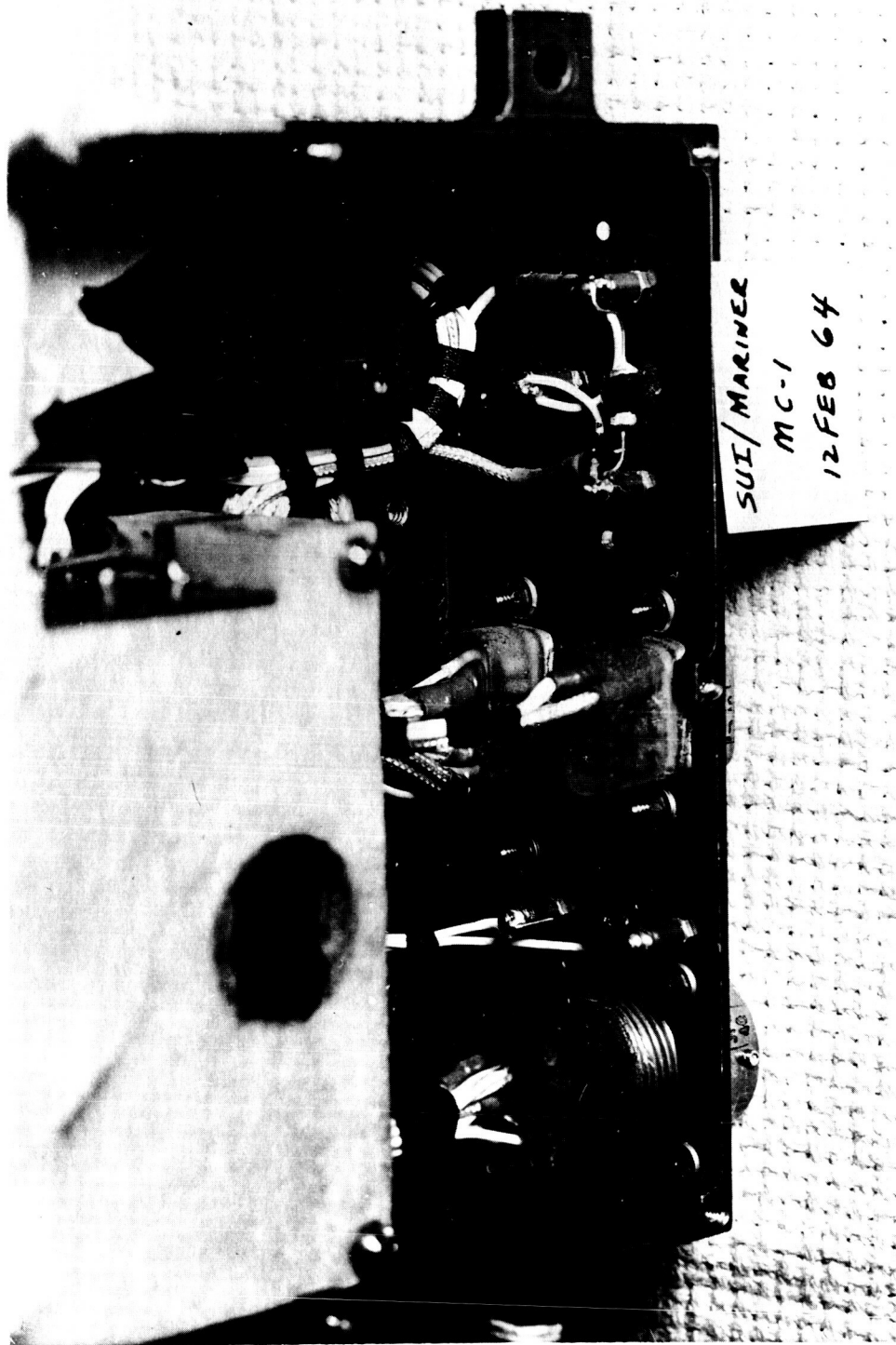
3/28/64

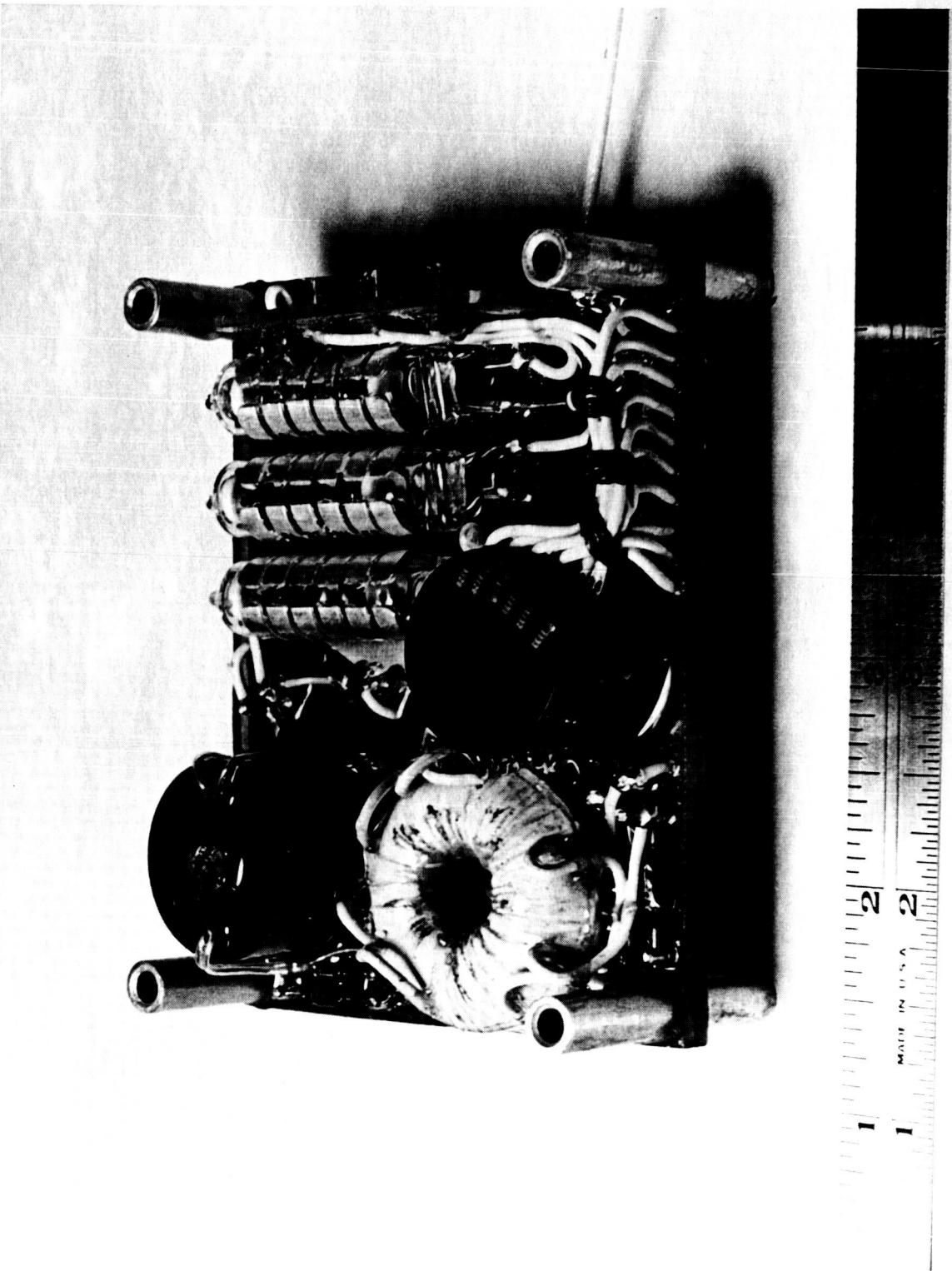
STATE UNIVERSITY OF IOWA N922/4

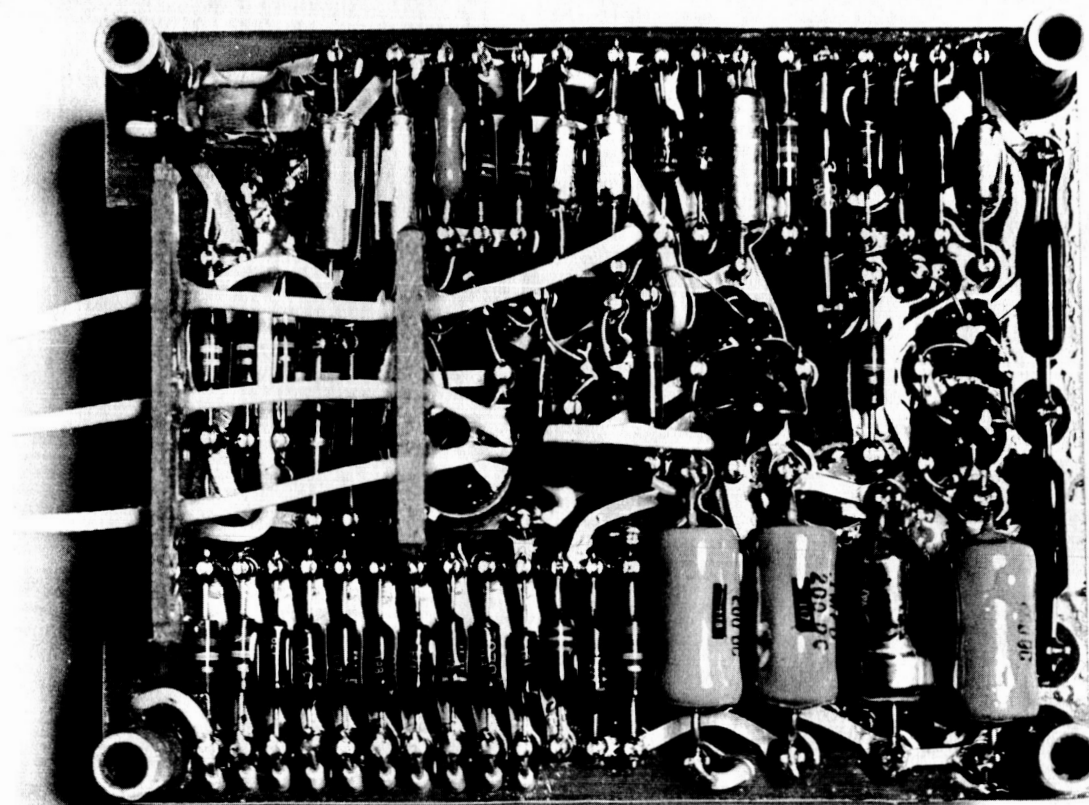




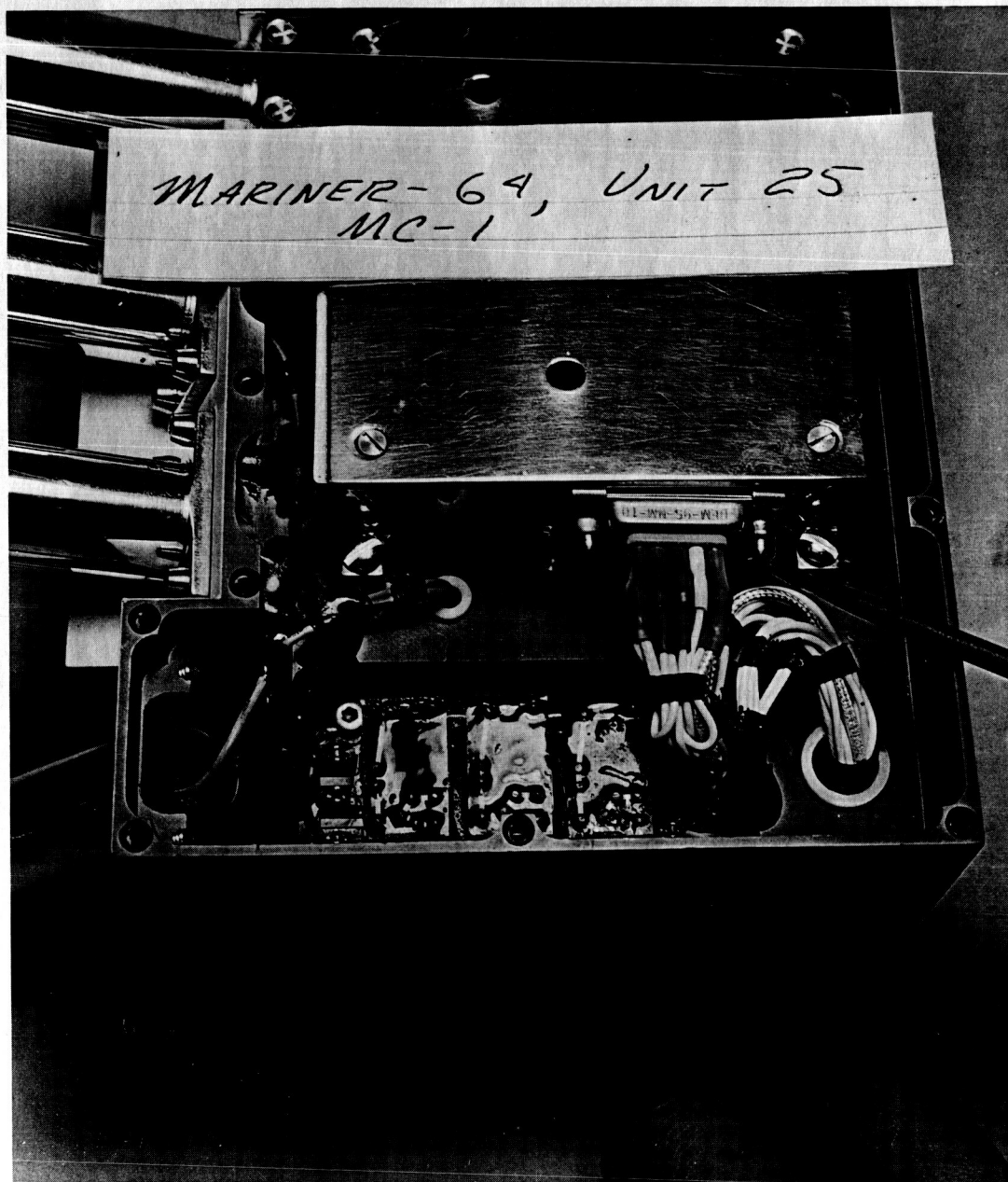


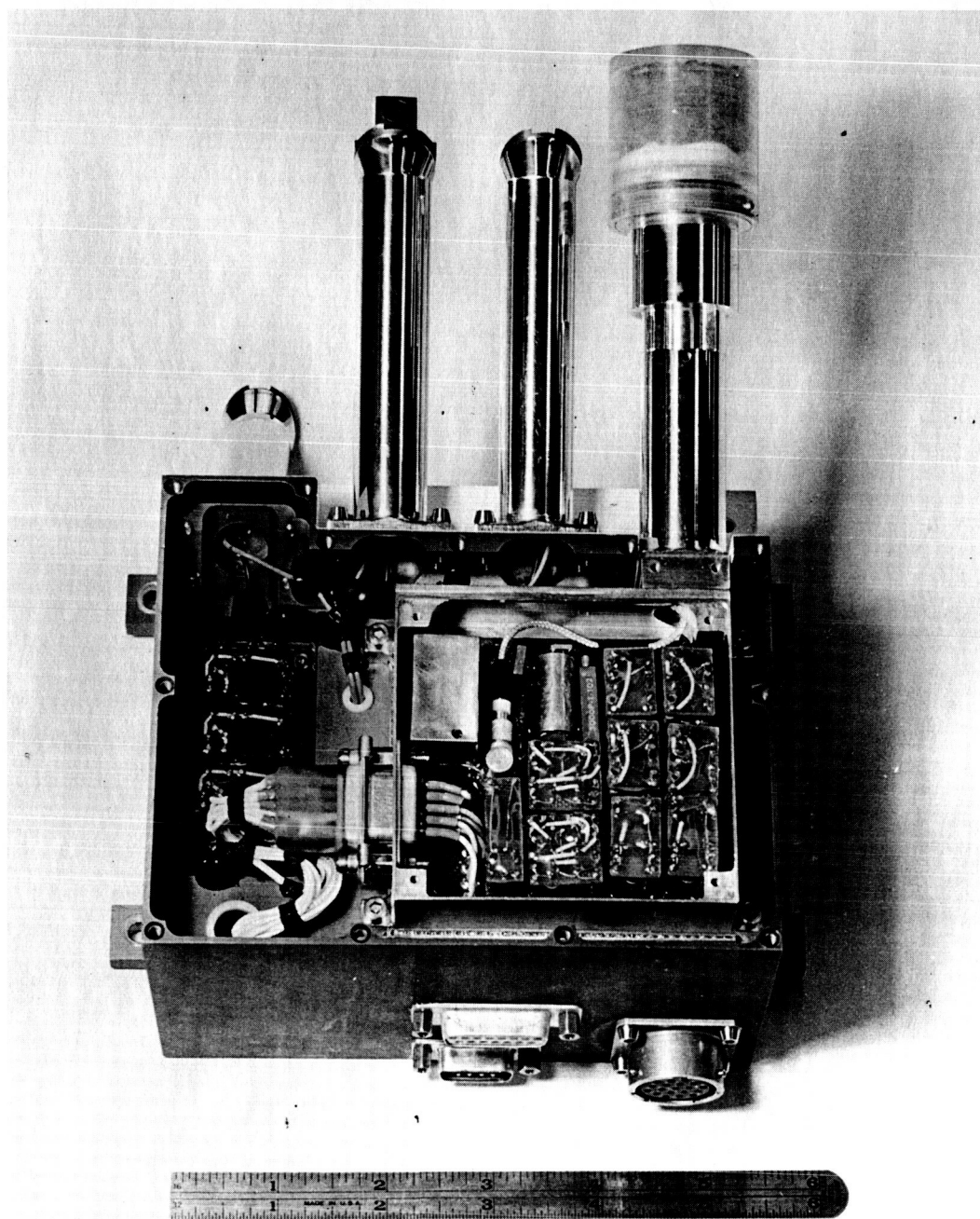






MC-1





SUI/MARINER C-64

MC-1 EXPERIMENT

